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ABSTRACT

Developed for elementary science studies, this unit on man and environment requires student involvement in discovery, observation, gathering and recording data, and problem solving. A series of 19 booklets, each designed as an activity which can be completed out-of-doors, comprise this student packet of materials. Topics studied in the activities include: adaptation, communities, consumers, decomposers and decomposition, food chains, habitat, hearing, land use, marshes, nutrients, producers, profit (land values), and wetlands. Each booklet tells the student what he will study, what he should be able to do, what he needs to know, what materials he needs, and how to do the activity. Questions to answer and questions to think about as well as other ways to do the activity are listed. To summarize all the topics of study, a story is written about community concern and planning for an environmental issue. This set of materials was field tested in the spring of 1972 by the Wisconsin Research and Development Center for Cognitive Learning.
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Cattails or Concrete?

Field Tested Spring 1972

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Cattails or Concrete ?

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the Environment

Alan M. Voelker, Principal Investigator

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Playgrounds and Profits

"Come on, Janet," called Tony. "It's time to go home."

"Just a minute, I want to see if the beavers will finish their house," Janet answered.

She stood quietly, her eyes glued to the beaver family. They were busily repairing their house that had been damaged during the winter.

"Come on now," Tony ordered. "Mom will be mad if we aren't on time for supper. Besides, the beavers won't finish today. Hurry."

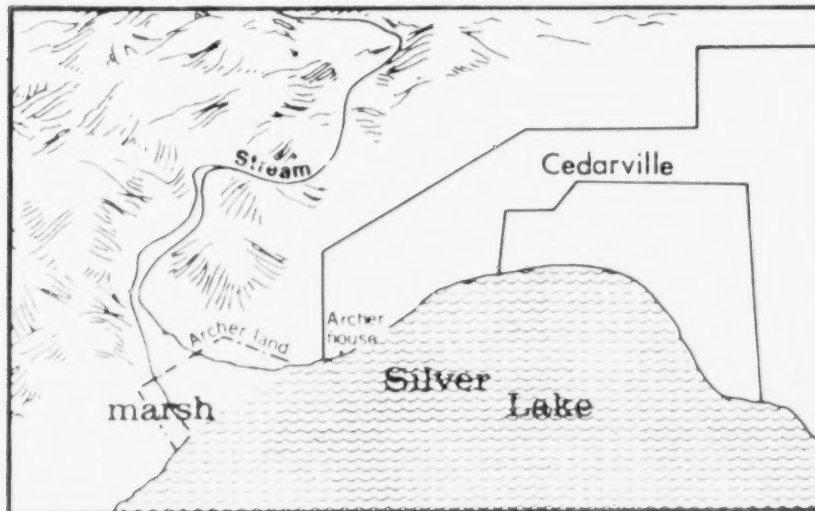
Janet finally went with Tony. "Aren't you glad this is our marsh?" she asked. Then she went on without waiting for an answer. "It's just the greatest place I know. Do you know what Meg, Sue, and I did yesterday?"

"What?" asked Tony only half interested.

"We followed some tracks. I think they were raccoon tracks. We didn't see any raccoons, though."

"That's because raccoons are usually active only at night," explained Tony.

Janet chattered as she walked. Tony answered now and then. Before long they were home. The Archers had lived in this house on Silver Lake as long as Tony could remember. Not long ago Mr. Archer, president of the local bank, heard that some land beside the lake was for sale. He bought it quickly for a cheap price. Since this land was close to the Archer's house, the children spent much of their time playing there. Their favorite place was around the marsh. It was in the middle of the land their Dad had bought.



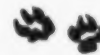
Tony, a sixth grader, didn't mind his little sister tagging along some of the time when he played around the marsh. It was fun sharing newfound treasures. Other times Tony would take his friends exploring there.

Janet and her fourth-grade friends thought the edge of the marsh was a great playground. They made up games using the footprints of the different animals. Most of the time it wasn't important to know the names of the animals leaving the tracks. The girls only had to see a difference among them. So the tracks of mink, raccoon, rabbits, and skunks prepared the land around the marsh for Janet, Sue, and Meg's game. Their mothers gave up scolding them for wet, muddy shoes and jeans. It did no good. They just couldn't keep the girls away from the marsh.

At home Mrs. Archer was busy making dinner when she heard a car drive into the driveway. "Now who's that?" she wondered as she looked out of the window.



Mink
Tracks



Raccoon
Tracks



It was Helen Davis. Mrs. Davis often stopped by on her way home from work. She was a very talkative lady. The Archer children believed that she broke the speed limit getting to their house so she could tell their mom all the news. And since Mrs. Davis was a member of the Cedarville City Council, president of Cedarville High PTA, housewife and mother, she always had news.

"Hello, Ruth."

"Hello, Helen. Come on in," said Ruth Archer. "I'll pour you a cup of coffee."

Mrs. Davis sat down with a sigh. "What a day I've had." She went right on, hardly taking time for a breath. "I heard today that the new highway might go through your land by the lake. I think that is a good idea myself. Especially since that land is worthless to you . . ."

"Wait a minute, Helen," interrupted Mrs. Archer. "Why do you think that land is worthless?"

"Oh come on, Ruth, most of your new property is just a soggy old piece of land. Without draining it you couldn't grow or build anything on it. Draining it would cost you a lot of money. And besides, it's so buggy!" Mrs. Davis went on, "Before today I didn't understand why you wanted to buy that worthless land. But now I've figured it out."



"And what did you figure out?" asked Mrs. Archer.

"You bought it so you could sell it for a profit. I bet you could make a nice profit if you sold that land to the state. You're so smart about money. Well, I really must get home," Mrs. Davis said, getting up to leave. "Thanks for the coffee, Ruth."

"Thank you for stopping by, Helen," said Ruth Archer as she returned to preparing dinner. "I wonder if we could profit by selling that land," she thought to herself. "If we want to profit, we'd

have to sell the land for more money than we paid for it." Another car driving into the driveway interrupted her thoughts. "That must be Fred," she said.

"Hi!" Mr. Archer said as he kissed his wife. After listening a minute he remarked, "It's so quiet. The kids must not be home."

"They left about an hour ago. They said they would be home in time for supper. Did you happen to hear about the council meeting this noon?" she asked.

"No," Mr. Archer answered. "I was busy with meetings all afternoon. But I bet Helen came over to tell you."

"Yes, she did. She said there was talk about the new highway going through our land by the lake. They . . ."

"The new highway is going to what?" interrupted Tony.

"Tony, I didn't hear you two come in," said Mrs. Archer. "But thanks for not slamming the door. Why don't we talk about all of this during dinner. If we start talking now our dinner will get cold. Go wash."

Tony and Janet quickly washed their hands. "What were they talking about, Tony?" Janet asked worriedly.

"I don't know," Tony answered. "Let's go find out."

Tony and Janet wasted no time getting to dinner.

"You two were sure fast," said their Dad in surprise.

"Now that we're here, will you please tell us about the new highway?" begged Tony.

"At the city council meeting today," began Mrs. Archer, "a new highway was discussed. According to Helen Davis, they talked about a route through our marshland."

"They want to put an icky old highway through our marsh?" interrupted Janet. "Why?"

"Well, if you'll let me finish," answered Mrs. Archer, "I'll tell you what I know. They think this land is worthless because most of it is marsh."

"Dad, you won't sell our marsh, will you?" asked Tony.

"Well, I might. The marsh is in the middle of our land. If I'd sell that land, the marsh would be sold too. And if I could make a good profit, I really think I'd sell it," Mr. Archer answered.

"But, Dad," cried Tony.

"What's a profit anyway?" asked Janet.

"Well, Janet, that may be a little hard to explain," answered Mr. Archer. "There are really

different kinds of profit. But they all have an exchange in them."

"I don't get it," Janet said.

"Let's take an example," Mr. Archer said. "One kind of profit would be the money you make in a business deal. A business deal is an exchange of things between two people. There is a cost and a gain for each person. And there is a profit if the amount of the gain is more than the amount of the cost."

"This's hard to understand," said Janet.

"After we finish dinner, I'll try to show you what I mean," suggested Mr. Archer.

Mrs. Archer added, "I'll even do the dishes by myself this evening."

"Gee thanks, Mom," said Tony and Janet at the same time.

After dinner Mr. Archer and the children went into the living room. "Now, let's think up an example of a profit," began Mr. Archer. "Remember, it has to have an exchange in it."

"Is selling our marsh a profit?" asked Janet.

"Yes, that's a good example of one kind of profit," said Mr. Archer. "Here the exchange is between two people, the buyer and the seller. Let's say that the state is the buyer. I'm the seller. Pretend

I paid \$400 for the marshland. Then I sell it to the state for \$500. Remember now, the profit is the difference between the cost of making or buying something and the selling price. So what would be my profit?"

"That's easy. You subtract \$400 from \$500. Your profit would be \$100," answered Janet, proud of her arithmetic.

"Very good, Janet," her father said.

"How about the state, Dad? Does it get a profit too?" asked Tony.

"I bet the state's profit would be space for a highway," Janet answered.

"That's right," said Mr. Archer. "Now you can understand why I might want to sell our marshland."

"Are profits always money?" asked Tony.

"No," his father answered. "There are other kinds of exchanges that don't have money in them. And they can be profits too."

"Like what?" asked Janet.

"How about in school?" Tony said. "My teacher always says that we would profit from listening to directions."

"That's a good example. In school the exchange is between the students and the teacher. The directions are exchanged. What do you pay the teacher for the directions?" asked Mr. Archer.

"We pay her our attention," Tony answered.

"That's good!" exclaimed his father. "And what do you gain?"

"We get our lesson done right if we listen," answered Tony.

"Is a lesson done right worth more to you than the time you spent listening?" asked Mr. Archer.

"Yes," answered Tony. "I feel good when I get my lesson done right. Is feeling good my profit?"

"I think that could be one of the profits. Do you think you profit by learning something new?" asked Mr. Archer.

"Sometimes," answered Tony.

"Now, the teacher has to give you directions in order to get your attention. What could be her profit?" Mr. Archer went on.

"I don't know," answered Tony.

"Do you think she profits by feeling good about her teaching?" Tony's dad asked.

"Maybe," answered Tony.

"Let's see if I can make a chart to help us understand the two kinds of profit we are talking about," Mr. Archer suggested.

When Mr. Archer finished the chart he held it up for the children to see. "Does this help you understand?" he asked.

TWO KINDS OF PROFIT

1. the money kind

	gain (what you get)	cost (what you give)	profit (the extra you get)
STATE	marshland	\$500	land for highway
MR. ARCHER	\$500	\$400 (amount paid for land)	\$100

2. the feeling good kind

	gain (what you get)	cost (what you give)	profit (the extra you get)
STUDENTS	directions	attention	feeling good about the les- son--learning something new
TEACHER	attention	directions	feeling good about her teaching

"I think I understand the money kind of profit," Janet said. "But what if you spent \$600 for the marsh. Then you sold it for \$500. The difference between the cost and the selling price is \$100. But the selling price is \$100 less than the cost you paid for the marsh."

"Then I wouldn't have a profit," said Mr. Archer. "I'd have a loss. When the selling price is less than the cost for making or buying something, there is no profit."

"But wait a minute, Dad," interrupted Tony. "If you sell the marsh, what about Janet and me? We lose the marsh but we don't gain anything. Is the money kind of profit so important?"

"Extra money could help pay for your education," answered his father.

"But Dad, what if we think the money for our education is not worth as much as our having fun now? Playing in the marsh makes Janet and me feel good. So, we sort of profit. But selling the marsh would take our profit away."

"I see what you mean. But you're talking about the feeling good kind of profit, and I'm talking about the money kind," said Mr. Archer. "Profit does not mean the same to everyone. In this case, I think I'm

right. The money kind of profit I get from selling the marsh will help pay for your education. And I think you'll profit more from your education than you will from playing around the marsh."

"But, Dad . . ."

"You will have to come up with a better reason for saving the marshland than just your enjoyment. If you can," he went on, "I will think about not selling it."

"Come on, Janet. Let's go think of a better reason," said Tony disgustedly.

"I'm coming, Tony. Thanks, Daddy," called Janet as she ran after Tony.

Mr. Archer chuckled to himself, "Kids just never worry about money!"

That evening the children couldn't think of another reason for saving the marsh. They tried so hard. But the same reason seemed to be the only one--the marsh was a great playground.

When Mrs. Archer called upstairs to tell them it was time for bed, the children promised each other to think again in the morning.

"I'm sure glad tomorrow is Saturday," thought Janet.

The Stranger in the Marsh

Janet's fall

Tony and Janet were up early the next morning. Both of them did their jobs quickly. Mrs. Archer didn't have to nag them this Saturday. By ten o'clock they were ready to go to the marsh.

"Bye, Mom and Dad," they called. "See you later."

"Goodbye," answered Mrs. Archer. Then she turned to Mr. Archer. "Fred, I don't know if we should sell that land or not. I know the extra money would be nice. But have you noticed how well those two have played together since we've let them play around the marsh?"

"Oh, come on now, Ruth, are you going to start in on me, too?" he asked. "Besides, the children will soon outgrow chasing frogs and picking cattails around the marsh."



"Perhaps," answered Mrs. Archer. "But I must say that I enjoy the peace between Tony and Janet. And look outside. It's a beautiful spring day. What else but the marsh would get the children to finish their jobs so quickly? What else would get them outside to play?"

Mr. Archer looked outside. It certainly was a beautiful day. The sun was shining. A gentle spring breeze was blowing. Mr. Archer stood thinking. He said to himself, "I just can't turn down the chance for extra money."

The children didn't stop to play on the way to the marsh. It was spring. The ducks and geese had returned. They had spent the winter in the South. Early every spring these waterfowl migrated north. The Archer's marsh was a resting place for geese which nest farther north in Canada. Most of them were gone by now. But some of the ducks stayed around the marsh. There they built their nests and raised their young.

Tony and Janet called the ducks that stayed "their" ducks. Both children remembered last fall. It had been an exciting time for them. They watched "their" ducks join the flocks heading south. Earlier this spring they had watched "their" ducks come back.



When the children got to the marsh they sat quietly at the water's edge counting the different kinds of ducks. They tried to count the blue-winged teal coming in to land. Then they added all of the mallards swimming busily in the water.

"Wow! I've counted over 75 ducks!" exclaimed Tony.

"What are these tracks?" asked Janet, getting up.

"They look like deer tracks to me," answered Tony. "Early in the morning deer come to the marsh to drink."

The children began walking slowly. They stopped to watch a turtle crawl onto a log. They looked for muskrats. Tony and Janet always saw muskrats paddling softly through the shallow water.

"I sure hope we don't find any skunks," laughed Tony.

"If we find any let's hope they're friendly ones," said Janet. Then suddenly she turned to Tony. "Hey, Tony, do you see that man over there? Do you think he is from the highway department?"

"I don't know," answered Tony. "Let's go over and see. Maybe if we watch him closely we can figure out who he is."

The strange man seemed to be doing just what Tony and Janet were doing--watching.

"What do you think?" asked Janet in a whisper.

"I don't know," Tony whispered back. "Let's get closer."

It was hard to tiptoe quietly. Last year's reeds were brown and dry, crackling under the softest steps. Janet was watching the stranger instead of watching where she was stepping. All of a sudden she slipped on some mud. "Help!" Janet cried as she went down.

"Shh!" Tony shouted in a whisper.

The stranger turned around.

"Now you've done it," Tony said disgustedly.

"He heard you. He's coming over here!"

"Can I help you?" the strange man asked.

Janet was too scared to answer.

Tony tried to help his sister get up. "My sister sometimes forgets to look where she's going," he said to the man. "What a dumb sister I have," he thought to himself.

The stranger didn't leave. He just stood there. Tony tried to think of a way to find out who the man was. While he was thinking Janet blurted out, "If you're from the highway department, you have to get away from our marsh!"

"Oh brother," mumbled Tony.

The stranger smiled and said, "No, I'm not from the highway department. Were you expecting someone from there?"

"Not exactly," Tony said hesitantly.

The stranger saw the confusion in the faces of the children. "I forgot to tell you who I am," he said with a smile. "My name is Dean Bronski." He put out his hand. "I am glad to meet you."

Tony shook hands with Mr. Bronski. "My name is Tony Archer. This is my sister, Janet."

Janet was still not sure about him. She hung back wondering, "What's he doing around our marsh?"

Then as if he had read her mind Mr. Bronski said, "I imagine you are wondering why I'm here. Did you say this was your marsh?"

"Yes, it is," Janet said firmly.

"Well, Janet and Tony, I am a biology teacher at the university. One day last summer when I was canoeing on the lake, I discovered your marsh. You have a terrific marsh!"

"You like marshes?" Janet asked eagerly.

"I sure do," Mr. Bronski answered. "I like to study the things living in a marsh."

Tony sighed with relief. Then he explained their

big problem. He wanted Mr. Bronski to understand why he and Janet acted like such nuts.

producers and consumers

Mr. Bronski was concerned. He certainly didn't want a highway going through the middle of the marsh. "I agree with you," he said. "The marsh is an interesting place to visit. It is also one of our important wetlands."

"What are wetlands?" Janet interrupted.

"Well, wetlands are wet lands," he laughed. "They are found along the shallow edges of lakes, rivers, and even oceans. You will also find them in low, poorly drained lands where water stands most of the year. There are many different kinds. Marshes are one kind of wetland. Marshes are wetlands that have no trees."

"But there are trees in our marsh," Janet said.

"No, Janet," Mr. Bronski replied. "Trees are growing around your marsh. There are no trees in your marsh. Remember, a marsh is a wetland. It has shallow water. Here where we are standing, there is no water. We are not in the marsh. We are beside the marsh. Look at the trees. Are they growing in water?"

"No," answered Janet.

"So they are not in the marsh," said Mr. Bronski.
"They are beside the marsh."

"Is a lake a wetland?" asked Tony.

"Well," answered Mr. Bronski, "we usually don't call lakes or oceans wetlands. Their water is too deep. In a wetland the water is shallow enough for plants to grow everywhere. Silver Lake," he said, pointing, "is too deep in the middle for plants to grow everywhere in it. It is not a wetland. Besides marshes, swamps and bogs are other kinds of wetlands."

Then he went on, "Remember, all wetlands have shallow water. And all wetlands have plants growing everywhere in them. Your marsh is a wetland. Marshes are wetlands with no trees growing in them. Their water is shallow and flows slowly. The shallow water and slow flow let many different rooted and floating plants grow in marshes. These plants are food and protection for redwing blackbirds, muskrats, mink, meadow mice, marsh wrens, frogs, and other animals. All of these living things are the marsh community."

"Is a marsh community made up of both the animals and plants living in it?" asked Janet.

"Yes," Mr. Bronski answered. "All of the living things in the marsh are part of the marsh community. The members of the marsh community work together."

There are producers and consumers.
The producers make the food that
consumers eat. Green plants are pro-
ducers. Animals are consumers."

"What do green plants produce?"
asked Janet, wide-eyed.

"Oh, green plants are very
special," smiled Mr. Bronski. "Green
plants are the only things that can
capture energy from the sun. Some
animals get some of this energy when
they eat green plants. Energy is
passed to the plant-eating animals
when they eat the green plants. Then
they have energy to do their ac-
tivities. Can you think of a plant-



Red-winged Blackbird

eating animal?" asked Mr.
Bronski.

"A cow eats grass. So
cows are plant-eaters," said
Janet.

"Some ducks eat plants,"
added Tony. "And snails
eat the scum off rocks at
the bottom of the marsh.



Marsh Wren

So both ducks and snails are plant-eaters."

"That's right," Mr. Bronski said. "Now remember, green plants are the producers. Animals are the consumers. Plant-eating animals are one kind of consumer. Meat-eating animals are another kind of consumer. What do you think meat-eaters eat?" he asked.

"Meat-eaters must eat plant-eaters," said Tony.

"Very good," said Mr. Bronski. "Many of them also eat other meat-eaters. Some energy is passed on to the meat-eating animals when they eat the plant-eating animals. Then the meat-eaters have energy for their activities. Can you think of a meat-eating animal?"

"Lions are meat-eaters," answered Janet. "And birds are too."

"Not all birds are," exclaimed Tony excitedly. "Sparrows and hummingbirds aren't."

"You're both right," said Mr. Bronski. "Some birds are plant-eaters and some are meat-eaters. There are even some animals that eat both plants and meat. You are one of the animals that eat both. Now the main source of energy here on earth is the sun. Would we get any of this energy without green plants?" he asked.

"No," answered Tony. "Hey, that's a kind of profit," he exclaimed.

"It is?" asked Janet, somewhat amazed.

"I think so," answered Tony. "Let's see now if I can explain it all. We must give plants room to grow. We gain the sun's energy when we eat the plants. We need this energy for work, play, and growth. So our profit is being able to work, play, and grow."

"But it isn't the money kind of profit, is it Tony?" asked Janet.

"No, there's no money. It must be more like the feeling good kind of profit," Tony answered.

"What do you know about profit?" Mr. Bronski asked.

"Just what our dad told us the other night," replied Tony. "He said there were different kinds of profit. Two kinds I remember are the feeling good kind of profit and the money kind of profit."

"Oh, I see," said Mr. Bronski.

"And Dad thinks the money kind of profit is very important," Janet added.

"I think I understand, Janet," Mr. Bronski said. "As you two get older, you'll see many people that think that way. But remember that feeling good about something can be as important as money."

Tony was glad that Mr. Bronski agreed with him.

"Could you tell us more about the green plants?" asked Janet.

"Well, now green plants capture the energy from the sun," Mr. Bronski said. "Plant-eating animals get some of this energy when they eat green plants. Meat-eating animals get the energy when they eat the plant-eaters and other meat-eaters."

"Wow! That's really neat!" exclaimed Tony.

"I understand how energy is passed from the sun to green plants and then to animals," said Janet.

"But what's the marsh community again?"

"The marsh community is made up of all the plants and animals living in the marsh," explained Mr. Bronski. "All of the living things in the marsh are the marsh community."

"Both producers and consumers make up a community," added Tony.

"That's right, Tony," Mr. Bronski went on.

"And all of the members of a community work together. They need each other."

"How?" asked Janet.

"Producers are the only members of the community that can capture the sun's energy," answered Mr. Bronski. "Consumers need this energy. Producers are also the only members of the community that can make food. Consumers need the nutrients in the green plant producers."



Mr. Bronski pointed out different kinds of producers and consumers while he talked. After a while he said, "I think you children have learned a lot today. Maybe we should wait until another time to learn more about the marsh."

"Will you talk to us again?" asked Tony.

"When?" begged Janet.

"I'll see you right here next Saturday morning," answered Mr. Bronski. "Is ten o'clock a good time?"

"It sure is, Mr. Bronski," the children said.

"Thank you! Bye!"

"Goodbye now," called Mr. Bronski.

Tony turned to his sister. "I'm glad you fell in the mud. We might have been too scared to just walk up and talk to Mr. Bronski. I'm sure glad he is our friend," Tony said.

"Me, too," said Janet. "I think he likes our marsh as much as we do."

The children tramped around the edge of the marsh, seeing things they had not seen before. Mr. Bronski had pointed out so much.

"Do you think it's lunch time yet?" asked Tony finally. He looked at his watch. "Good grief! It's almost three o'clock. We missed lunch!"

"I didn't know I was hungry until now," said Janet. "Do you think Mom will let us eat something?"

"Let's ask for fruit. She always lets us have that," Tony answered.

The children hurried home.

"Hi, Mom! We're home," Tony called.

"Can we have an apple?" asked Janet.

Mrs. Archer came down from upstairs. "Where have you two been? I was beginning to think you were lost. Do you know you missed lunch?" she asked.

"We didn't know until just a few minutes ago," answered Tony. "We met this . . ."

"Why don't you use your watch?" interrupted his mother. "Why do you think we gave you one?"

"But, Mom! We met Mr. Bronski and--oh never mind. Can Janet and I have some apples?"

"I guess so," answered Mrs. Archer. "Be sure to wash your hands first," she said as she left the room. "Next time tell me when you aren't going to be home for lunch."

"Mothers!" said Tony, shaking his head.

Tony and Janet talked happily while they ate. Mr. Bronski had told them so much. Both children wanted to share what they had learned.

"Monday after school I think Chuck, Bob, and I'll go play around the marsh," said Tony.

"I think I'll take my friends, too," said Janet. "Wow, what a day we've had."



Who Needs Marshes ?

plants → *insects* → *frog* → *snake*

The children were quiet during dinner. Before dinner they had decided not to talk about Mr. Bronski. At least they were not going to tell their parents about him. "Mom will say that we shouldn't be talking to strangers," Tony had said.

The children went upstairs when they finished doing the dishes. They wanted to make plans for the coming week. When Tony went back to his room for a book, he overheard his parents talking.

"I didn't want to talk about this in front of the children," Mr. Archer began. "A farmer from Nellington came into the bank today. He said the state paid him \$1,000 an acre when they built the highway through his good farmland. I think the state might pay us \$500 an acre for our marshland. Do you realize

the profit we could make? I bought that land for \$400 an acre! Subtract \$400 from \$500 and you have the profit we'd make."

"I didn't realize they might offer us so much," said Mrs. Archer. "Goodness, \$100 an acre is quite a profit! Let's see now," Mrs. Archer began thinking. "There are about 100 acres of marshland. So 100 times \$100 would be \$10,000!" she exclaimed.

"Now do you see why we should consider selling that land?" Mr. Archer asked.

"Yes, I do," answered Mrs. Archer. "But, I'm still not sure that the money is worth more than peace between Tony and Janet. And besides, they get their work done faster and don't complain about it. And they spend more time outdoors. All of that is worth something to me."

"Ruth," interrupted Mr. Archer, "\$10,000 is a large sum of money!"

"I know. You're right," agreed Mrs. Archer. "\$10,000 would be nice."

Tony went running back to Janet's room. "Janet," he whispered worriedly, "guess what I just heard! Dad thinks he might be offered a lot of money for our marsh! He really wants to sell it!"

"Oh, no!" cried Janet. "We just have to stop him!"

Mrs. Archer called up, "It's bedtime, you two."

Tony left Janet's room again. "Please Tony," begged Janet. "Think of something!"

The week went by quickly. Several afternoons Janet, Tony, and their friends played around the marsh. Tony explained how a marsh is an important wetland. He also pointed out different members of the marsh community. Janet explained that all of the living things in the marsh are the community. And the living things are divided into two groups. The green plants are producers. And all of the animals are consumers.

Tony also pointed out, "There are different kinds of consumers. Some are plant-eaters. They get some of the sun's energy when they eat plants. Others are meat-eaters. They get some of the sun's energy when they eat plant-eating and meat-eating animals."

"And green plant producers are important because they are the only living things that can capture the sun's energy," Janet added.

The children were happy when they were at the marsh with their friends. But at home they worried. Janet still could not think of a good reason for saving the marsh. Tony couldn't either. Both of the children were sad and droopy around the house.

Saturday finally came. The children again

finished their work quickly. They were going out of the door by 9:30 that morning.

"See you later, Mom," called Tony.

Janet added, "We took some apples for our lunch. We'll eat beside the marsh. Okay?"

"Yes, you may take the apples. And yes, you may stay at the marsh for lunch. Have fun," she called after them. She couldn't help smiling. "Money just can't buy that kind of fun and friendship," she thought to herself. Then her smile changed to a small frown. "But Fred is probably right about selling that land."

Tony and Janet ran nearly all the way to the marsh. When they got there they looked eagerly for Mr. Bronski.

"Maybe he forgot," panted Janet. "Maybe he doesn't want to be bothered with us!"

"Quit worrying," said Tony. "Maybe we're a little early. Let's sit here and watch while we wait."

While the children waited they watched a frog. He was busily catching bugs as they flew by.

"How many bugs do you think he'll eat?" asked Janet.

"I don't know," answered Tony lazily. Suddenly he sat up. "Look at that snake, Janet," he said in a half whisper.

The snake slithered slowly toward the frog. Every few inches it would stop. Its forked tongue darted in and out. The frog was much too busy catching his breakfast to see the snake. He didn't realize that he was in danger. All of a sudden there was a surprised croak. Faster than the children could see, the snake had caught the frog's back leg. The frog pulled and tugged. He tried to get away from the snake. But the snake won. Tony and Janet hardly moved. They watched the snake take more and more of the frog into its mouth. The snake could stretch its mouth as if it were made of rubber. Finally, the children could no longer see the frog. All that was left was a large lump in the snake's throat.

"Oh!" cried Janet. "Oh, Tony! That mean old snake ate the frog."



"The snake has to eat, too," said Tony. "You didn't complain when the mean old frog ate the bugs."

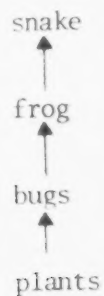
"Or when the mean old bugs ate the plants," added Mr. Bronski.

"Oh, hi, Mr. Bronski," said Janet. "I didn't hear you come."

"Do you know what you have just seen?" asked Mr. Bronski.

The children didn't answer. They were still thinking about what had just happened. Mr. Bronski understood. He wrote in his notebook for a few moments. Then he said again, showing them what he had just written, "Do you know what you have just seen?"

Tony looked at the paper and saw what Mr. Bronski had written.



"The plants were eaten by bugs. The bugs were eaten by a frog. The frog was eaten by a snake," Tony thought to himself. Then he said out loud, "It's a food chain. We just saw a food chain."

"That's right," said Mr. Bronski. "You will find many food chains in your marsh. Do you know that food chains work together?" he asked.

"How?" Janet asked, quite puzzled.

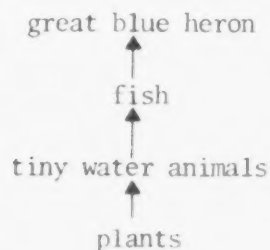
"Well," Mr. Bronski began. "Can you think of another animal that might eat the frog?"

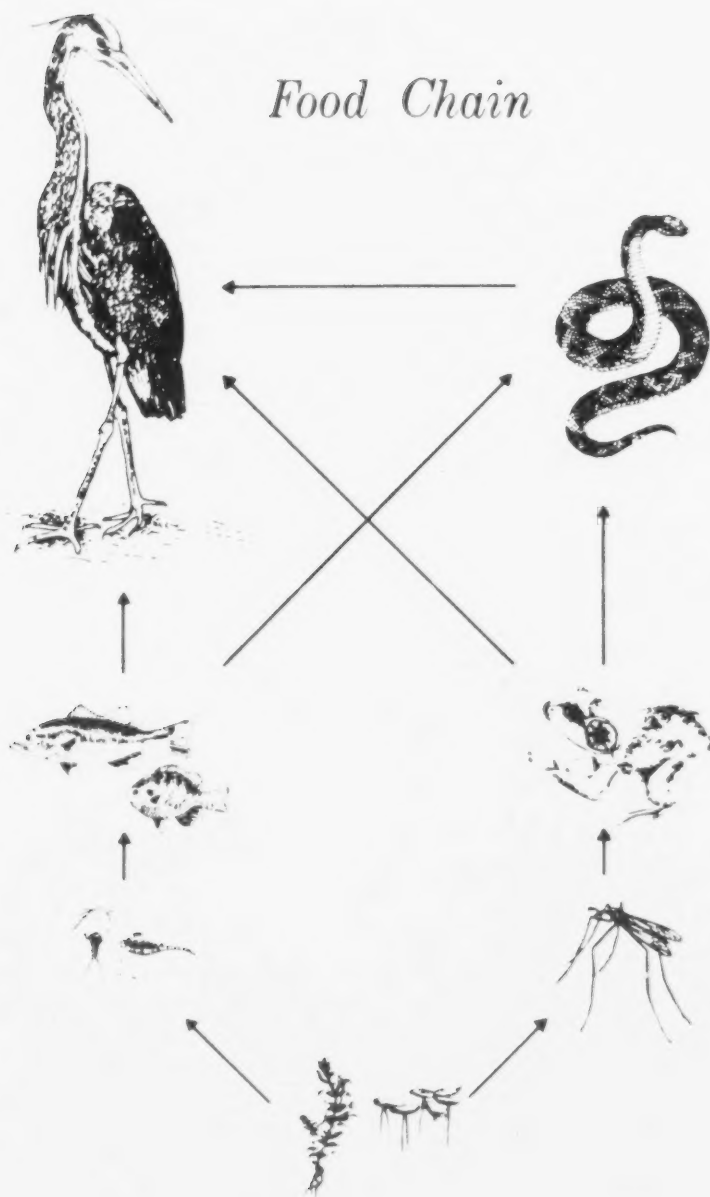
"Do birds eat frogs?" Tony asked.

"Yes, big birds do," answered Mr. Bronski.

"The great blue heron comes to the marsh to eat frogs and snakes. It also eats fish. Fish eat tiny water animals. Tiny water animals eat plants."

Mr. Bronski wrote as he talked. He showed the children his paper.





"Now we're back to plants," said Janet. "Plants were the beginning of the other food chain too."

"That's right," said Mr. Bronski as he pulled a picture out of his pocket. "Here are the two food chains we have talked about."

"Now I see," said Tony. "Different animals eat some of the same things. Some animals eat from more than one food chain. The food chains are not separate."

"Exactly!" said Mr. Bronski. "All food chains in the marsh community are linked together. And all food chains start with green plants."

circles and chains

Suddenly Janet remembered her father's plans.

"Oh, Mr. Bronski, do you know what?"

"What?" he asked.

"My dad thinks he can sell our marsh for a lot of money and he thinks money is important," she answered.

"Money can be important," Mr. Bronski explained. "But marshes are important, too. In fact, all wetlands are important. But today let's talk about what makes your marsh important. Do you remember what we were talking about last Saturday?"

"You told us about the marsh community," answered Janet. "You said the marsh community is made up of all of the living things in the marsh."

"Yes, I did," Mr. Bronski said. "And the living things are divided into two groups. There are producers and consumers. Do you remember what producers are?"

"Green plants are producers," answered Tony. "They are producers because they can capture energy from the sun and make food for themselves. Then these producers can become food for consumers. All of the animals are the consumers."

"Very good, Tony. Now let's look for producers in your marsh," Mr. Bronski went on. "How many different kinds can you find?"

"I can find cattails," said Tony.

"Cattails are food for muskrats," said Mr. Bronski. "And mink eat muskrats."

"That's another food chain," Janet said. "Cattails are the green plant producers. Muskrats and mink are the consumers."

"That's right," said Mr. Bronski.

Tony reached out into the water. "Water lilies are producers," he added, as he held one up. "Mr. Bronski, look, the water lily's leaves won't stay up."

"Do you know why they won't?" asked Mr. Bronski.

"Do they need the water to hold them up?" Tony asked.

"That's right. Its wide flat leaves keep the water lily floating. These flat leaves also help the water lily capture energy from the sun. We say the water lily has adapted to living in shallow water."

"I see," said Tony, looking at the water lily. "This plant couldn't float if it had thin leaves like the reed Janet is holding."

"That's right. The leaves of water lilies are a kind of adaptation," Mr. Bronski explained. "Last week Janet showed how she has not adapted to a muddy marsh. Remember when she slipped in the mud?"

"Oh, yeah," said Tony.

"If she had adapted to the marsh her feet would not slip on the mud. Maybe they would have sharp toenails that would dig into the mud," Mr. Bronski explained. Then he held up another green plant. "This is a bladderwort. Look at its leaves. Do you see these little bags?"

"Yes," answered Tony. "What are they for?"

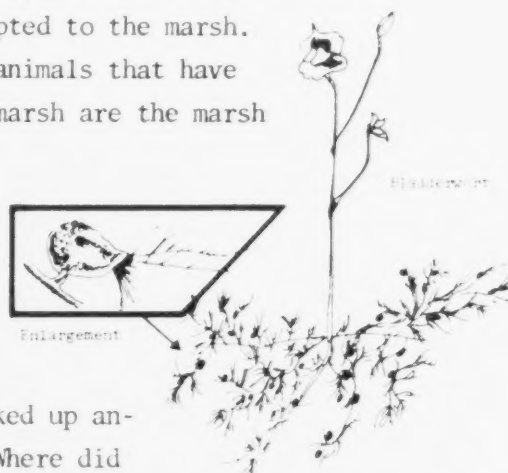
"This is another kind of adaptation. This plant also has adapted to living in the water. These little bags act like traps. They help catch tiny animals living in the marsh," explained Mr. Bronski.

"Do you mean this plant eats animals?" asked Janet in surprise.

"Yes, the bladderwort is a meat-eating plant. Its food trap is the bladderwort's adaptation. These plants have adapted to the marsh. All plants and animals that have adapted to the marsh are the marsh community.

They couldn't live in deserts, oceans, or house basements." Then

Mr. Bronski picked up another plant. "Where did I get this waterweed?" he asked.



"It was under water," answered Tony.

"Some plants have adapted to live under water," Mr. Bronski explained. "But the water must be clear. Otherwise these plants could not get energy from the sun. Cloudy water would keep out the sun's rays. Plants do not grow where the sun's rays can't reach them."

Tony picked up some green scum from the water.
"What's this?" he asked.

Mr. Bronski answered, "You have a handful of algae. You always find algae in a marsh. Algae, in fact, are the most important producers in the marsh."

Mr. Bronski was showing the children different producers in their marsh when Janet asked, "Do green plants need just the sun?"

"No," answered Mr. Bronski. "They also need nutrients."

"Are nutrients food?" asked Janet.

"Sort of," answered Mr. Bronski. "Nutrients are those materials that living things need to grow and stay alive. Different living things need different nutrients. Some minerals are nutrients for some living things. Carbon dioxide is a nutrient for plants. Oxygen is an important nutrient for animals."

"So we need nutrients too," said Janet.

"Yes, we do," Mr. Bronski agreed. "We get oxygen from the air. We get minerals and iron from some of the foods we eat. Does your mother say you have to eat vegetables before you eat dessert?"

"Yes," answered Janet.

"That is because certain minerals and vitamins are in vegetables. They are not in cake, cookies, and

ice cream. We can get most of the nutrients we need from fruits, vegetables, meat, and milk," Mr. Bronski went on. "Green plants can get the nutrients they need from the air, the water, and the soil."

"Does Dad give our grass nutrients when he puts fertilizer on it each spring?" asked Tony.

"Yes, he does," answered Mr. Bronski. "These nutrients let more grass grow. And they make the grass healthier. Some fertilizer is washed off by the rain. It may wash into the stream or into Silver Lake. Then the plants in the stream or lake can use the nutrients in the fertilizer."

"My dad doesn't fertilize the marsh. How does it stay healthy?" asked Janet.

"That's a very good question, Janet. But before I can answer it, you need to know something else. Remember, the marsh community is all of the living things that live and work together in the marsh. It's important to remember that the members of the community need each other," Mr. Bronski explained. "How do you think consumers need producers?"

"Consumers can't make their own food. They need the energy and nutrients in producers. Producers are the only living things that can make food," answered Tony.

"And green plants are the producers," answered

Janet with a proud smile.

"Good, Janet, you are learning. Now, how about the opposite? How do producers need consumers? Who are the consumers?" Mr. Bronski asked.

"Animals are consumers," answered Tony.

"That's right," Mr. Bronski said. "Living things that cannot make their own food are consumers. Animals and non-green plants are these living things. Plant-eating and meat-eating animals are kinds of consumers. Decomposers are another kind of consumer."

"What are decomposers?" asked Janet.

"Decomposers are those consumers that cannot hunt and catch their own food. They also have no real mouths. So they don't eat like other consumers. Plants that aren't green and some tiny animals are decomposers."

"I've never heard of non-green plants," said Tony. "I don't think I've ever seen any either."

"Yes you have," said Mr. Bronski. "Fungi are non-green plants. So fungi are decomposers. Mushrooms are a kind of fungus. So mushrooms are non-green plants. And mushrooms are decomposers. Bacteria are another kind of decomposer."

"What are bacteria?" asked Janet.

"Some germs that can make you sick are a kind of bacteria. Bacteria can also make milk sour. They

are very tiny living things. You can't see them without using a microscope."

"What do decomposers do?" asked Janet.

"Janet, give Mr. Bronski a chance. Don't ask so many questions," said Tony disgustedly.

"Decomposers separate dead plants and animals into simpler parts," answered Mr. Bronski. "They get their energy and nutrients by consuming these dead plants and animals. They do not use all of the nutrients from within the dead plants or animals. The decomposers return the rest of the nutrients to the water, soil, and air. Then producers can get the nutrients. That is how the marsh stays healthy."

"Wow!" exclaimed Tony. "It's like a circle. The consumers get nutrients from producers. And the producers can get nutrients because decomposers put nutrients into the air, water, and soil."

"That's right. And remember, decomposers are the kind of consumers that producers need. Decomposers return the nutrients for the producers to use," Mr. Bronski went on. "In your marsh, for example, the nutrients go into the soil and the water. Plants get the nutrients from both soil and water. The green plants, or producers, then pass the nutrients on to consumers. It's like Tony said. It's a big circle."

The nutrients go from producers to consumers to decomposers and back to producers again. The decomposers' important job is returning the nutrients so the producers can get them again. This circling of nutrients keeps the marsh healthy."

"Mr. Bronski," said Janet, a little confused. "You said decomposers separate dead plants and animals into simpler parts. What are simpler parts?"

"Janet, decomposition is not easy to understand. Let's think of an example. Do you like apples?" Mr. Bronski asked.

"Sure," answered Janet. "We brought some along to eat."

"Very good," said Mr. Bronski. "Let's suppose one of your apples falls on the ground and you don't pick it up. What happens to it?"

"It gets rotten," answered Tony.

"That's right," Mr. Bronski went on. "But the apple doesn't rot by itself. Decomposers are at work. They are separating it into simpler parts. What happens first?"

"It gets brown," answered Janet.

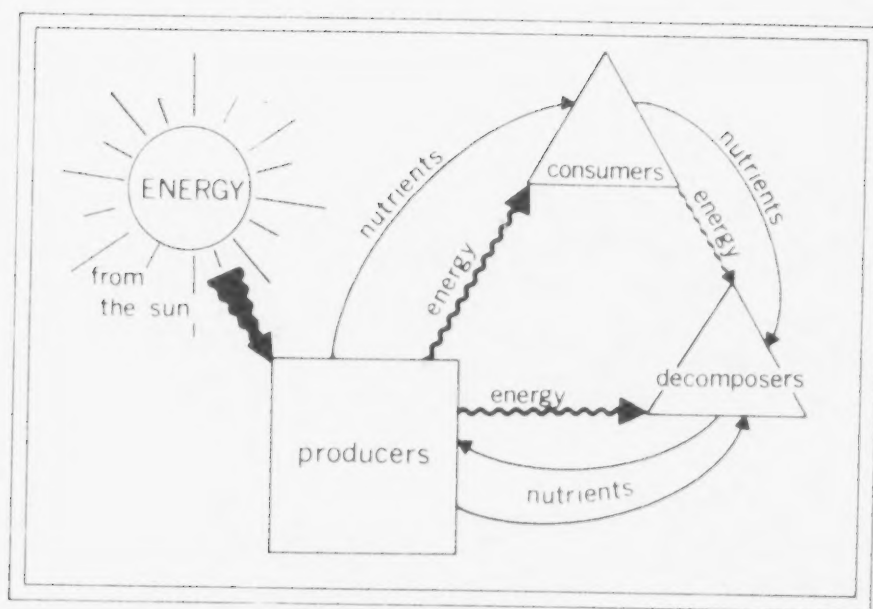
"It also starts to shrivel up," added Tony.

"That's right," Mr. Bronski said. "And it finally disappears from sight. Some of the nutrients



from the apple would first be used by the decomposers. Some of the nutrients also would go directly into the soil. There plant roots would get the nutrients. Now, if you had picked up the apple and eaten it, you would have received the nutrients," said Mr. Bronski.

"It's important to remember that nutrients can keep circling as long as plants get energy from the sun. Plants cannot make food without the sun's energy. Plants couldn't live without food. And animals couldn't live without plants. You should also remember that energy does not go in a circle. It is passed on. But each time energy is passed, some is lost. Plants must always get new energy from the sun. I'll draw a picture to show you what I mean. This  line stands for energy," he said as he drew in the mud. "The wider the  line is, the more energy it represents. You see, a great amount of energy comes from the sun. The producers capture some of it. I'm making a very large box for producers because there are more producers than there are consumers or decomposers. Now, some energy and nutrients pass to consumers. Some energy and nutrients pass to decomposers. This curved line  stands for nutrients."



"Why do the decomposers get some of the nutrients before the consumers do?" asked Janet.

"Many plants die before they are eaten by a plant-eating animal," answered Mr. Bronski. "They are just decomposed."

"Look," said Tony, pointing to the picture. "There's no energy going from decomposers to producers."

"You're right, Tony," said Mr. Bronski. "Decomposers use up the energy that is left. There is no energy to pass on to the green plant producers. These producers can only get energy from the sun. Remember,

all living things must have energy or they won't live. Only producers can capture the sun's energy and pass it on to consumers. Consumers are living things that can't capture the sun's energy. We must have green plant producers if consumers are to get any energy."

"We sure need each other!" exclaimed Janet.

"We sure do!" agreed Mr. Bronski. "And that's what a community is all about. It's made up of living things, plants and animals. They all stay alive because of the never-ending work of producers, consumers, and decomposers. Your marsh is full of producers, consumers, and decomposers. All wetlands are. Are you beginning to see how important wetlands are?"

"Yes," answered Tony.

Then Mr. Bronski went on. "Different kinds of wetlands are important for different reasons. Let's talk about how important your marsh is. This stream flows toward Silver Lake. It carries mud, leaves, sand, dead animals, fertilizer, and maybe even some poisons. The faster the stream flows, the more materials it can carry. Now the flow slows down when the stream reaches the bottom of the sloping land. And when the stream slows, it dumps many of the materials it is carrying. Your marsh is at the bottom of the sloping land. So the water flows slowly in the marsh.

And many materials are dumped in the marsh before the water enters the lake."

"But why is that important?" asked Janet curiously.

"It is important for two reasons," began Mr. Bronski. "One, there is the problem of nutrients. The dead plants and animals brought downstream will be decomposed. Their nutrients will be added to the marsh. These nutrients let lots of green plants grow in the marsh. This way the marsh is well fed. Now we don't want the lake to be so well fed. Who wants a lake too full of green plants? No one wants to go swimming where there is so much algae and scum in the water.

"The marsh helps keep the lake from being overfed. The slow flow doesn't let all of the nutrient-filled materials get into the lake at the same time."

"What is the second reason?" asked Tony.

"Two, there is the problem of oxygen," Mr. Bronski went on. "Decomposers use oxygen. If the lake has too many dead plants and animals to be decomposed, its oxygen supply will be used up by decomposition. Then many kinds of fish



Waterweed

and other life in the lake will die. When so many fish and other water animals can't live in a lake, some people say the lake is dead. It really isn't dead. There are still living things in the lake. But they aren't the same ones as before. And man doesn't think they are as good as the living things that once lived there."

"So the marsh really is important!" cried Tony in delight. "Now we have two reasons to give Dad. Maybe now he won't sell our marsh!"

"You sure do have good reasons," said Mr. Bronski. "Now I must be going. I'll see you here next week."

"Okay, Mr. Bronski. And thanks so much," said Tony.

"Bye," waved Janet. There was a real smile on her face now.

Both children practically flew all the way home.

"I can't wait to tell Dad our reasons for keeping the marsh," said Janet, panting.

"Yea," agreed Tony.

They both felt so good. But when they got home their mother said, "Your father was called out of town for a business meeting. He won't be home until Thursday noon."

that Thursday

The children thought Thursday would never come. But it did.

The day had started out okay. Janet had felt good. After all, her dad would be home this afternoon. At school her class was studying nutrition. "Good nutrition," Mrs. Osborne said, "is eating the right foods. The right foods are the ones that give us energy to do our work and nutrients to help us grow and stay alive."

It was then that Janet raised her hand eagerly. "I know where the energy comes from!"

Mrs. Osborne asked Janet to explain.

"Well," Janet began, "the sun is the main source of energy on our earth. Green plants are the only things on earth that can catch the sun's energy. They use this energy to make food for themselves. Plant-eating animals get some of this energy when they eat the green plants."

"Very good, Janet," said Mrs. Osborne. "And when you eat lettuce, green beans, or apples, you also get some of this energy."

"Do we get energy when we drink milk?" asked Billy.

"Yes, we do," Suzie answered. "A cow is a plant-eating animal. She uses some of the energy she got from the plants to make milk. We get the energy from the milk when we drink it. Some energy is passed to meat-eating animals when they eat the plant-eating animals. When you eat a hamburger you are getting some energy from the steer. The steer got the energy from the green plants. And the green plants got their energy from the sun. I think there is another name for green plants. But I don't remember it."

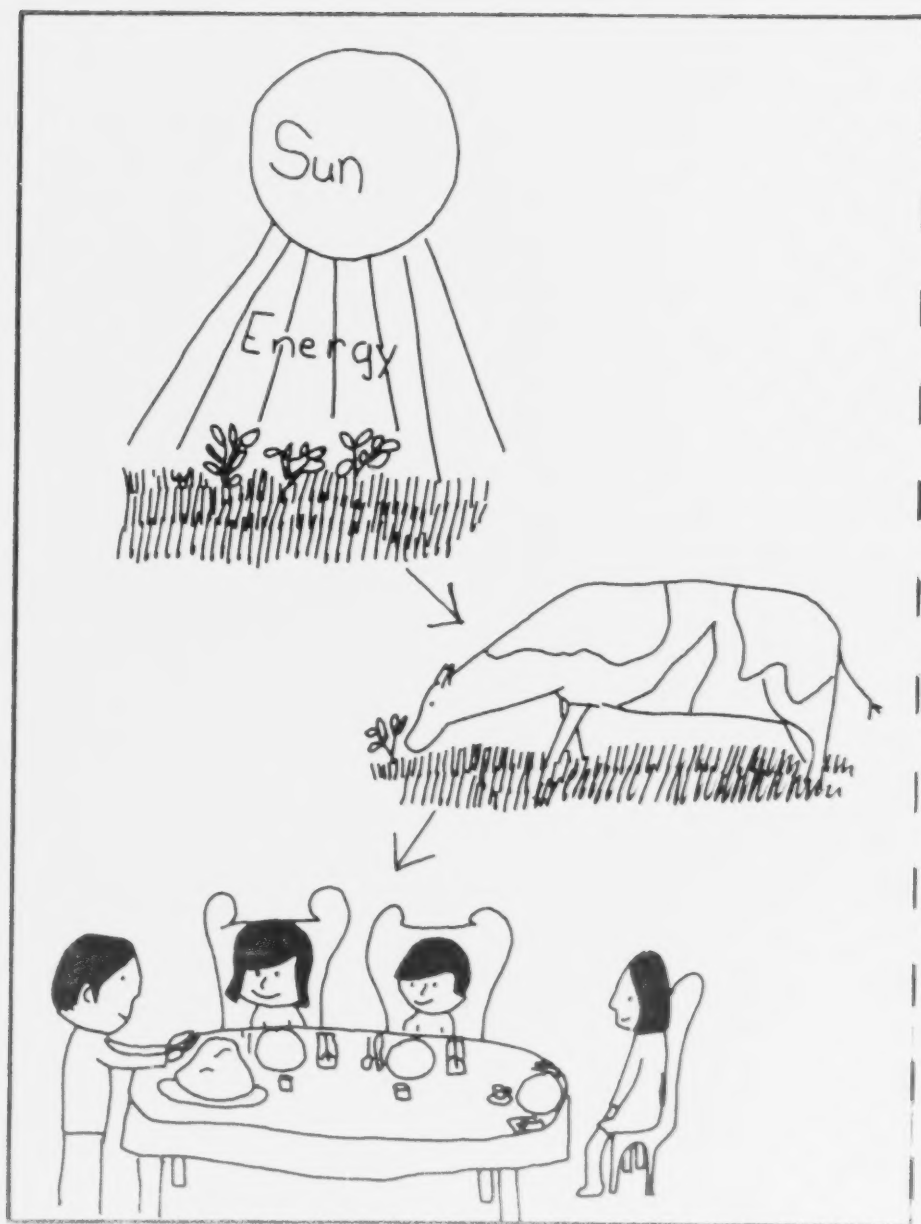
"Let's see," Janet said. "I remember. Green plants are called producers. And all animals are called consumers. Both plant-eating and meat-eating animals are consumers."

"That's right, Janet. Where did you learn about producers and consumers?" Mrs. Osborne asked.

"Our friend Mr. Bronski told me. He knows all about marshes," Janet answered.

"Would you make a picture that shows us how energy from the sun is passed to us?" Mrs. Osborne asked Janet.

Janet quickly made a picture for the bulletin board. It was such fun. Mrs. Osborne was very pleased with it. She held the picture up for the class to see.



"Didn't Janet do a fine job?" asked Mrs. Osborne.

"Look," exclaimed Suzie. "Everything is hooked together with the arrows!"

"Can you think of anything else that is hooked together?" asked Mrs. Osborne.

"My belt is," said Jimmy.

"A chain is," added Billy.

"Janet's picture does look like a chain. The energy goes from the sun to the plants to the steer to the family eating dinner," Suzie exclaimed.

"You're right. It's part of a food chain. Along with the energy the plants pass along nutrients," Mrs. Osborne explained.

"I know another food chain," said Eric. "The farmer sends the vegetables to the store. The store sells the vegetables to my mother. My mother fixes the vegetables for dinner."

"No, Eric, that's not a food chain," said Mrs. Osborne.

"Why not?"

"Food chains always begin with green plant producers. And in a food chain consumers get energy and nutrients when they eat. You are a consumer. But you don't get any energy or nutrients when your mother buys vegetables at the store. The store didn't

get any nutrients or energy when it bought the vegetables from the farmer."

"Now I get it," said Eric. "The vegetables my mother bought would be the beginning of the food chain. Vegetables are green plants. I'd get energy and nutrients if I ate the vegetables. So the food chain is just the vegetables and me."

"Very good, Eric," said Mrs. Osborne. Then she turned to Janet. "Thank you, Janet. We will put your picture here," she said, pinning it on the bulletin board.

Janet felt so happy and proud. After school she ran to meet Tony. They hurried home to talk to their father. But when the children got home from school, they saw a strange car in the driveway. On the side of the car was written STATE HIGHWAY DEPARTMENT.

"Oh, no," said Tony. "I bet the highway department is here because they want our marsh."

"If someone is talking to Dad, we can't tell him why the marsh is so important," said Janet.

The children went into the house. Janet helped herself to three cookies. "Do you want some?" she asked Tony.

"Shh!" Tony whispered. "Let's listen. Maybe we can hear what is going on in the living room."

"Tony!" Janet whispered loudly. "That's not polite!" And with that she walked right into the living room. She didn't interrupt. She just sat down and listened.

"So you can see, Mr. and Mrs. Archer, there are two possible ways the highway can go," the man said, pointing to a map as he talked. "But going through your land is the shortest route. You can see how much longer the way is if we go on the other side of these rocky hills.

"I'm sure the people of Cedarville would rather the highway bring travelers close to the city. A town can make a lot of money from travelers. They need to eat, sleep, and shop.

"Now, the state would pay you a good price for your land," he went on. "Going through your land is really the cheapest way for us to go, anyway."

"Do we have to decide now?" asked Mrs. Archer.

"No," answered the man. "But you realize, don't you, that the state could condemn your land. That means we can take it whether you give permission or not."

"You mean we couldn't do anything?" Mrs. Archer asked.

"I don't think there is much you could do if the state decided on the route through your property,"

replied the man. "There will be a hearing the first of June. A hearing, you know, is where different sides can present their arguments. At that time the members of the state highway commission will listen to all sides. They are the ones who will make the decisions. You can argue at that time for another location if you want. At any rate we will pay you well," he said as he got up to leave. "You will not be cheated."

"Thank you for explaining it to us," said Mr. Archer as he shook the man's hand.

As soon as the car drove away, Tony nearly shouted, "Dad! Mom! You won't let the state just take our land, will you?"

"Tony, calm down," his dad said. "Of course the state won't just take our land. They will pay us for it."

"But Dad," Tony went on. "That's not fair."

"The law says it's fair," Mr. Archer replied. "You see, the state can take someone's land. All they have to do is prove that the particular piece of land is necessary for the good of the public."

"What do you mean?" asked Janet.

"If the state can prove that a specific piece of land is needed for all the people, it can take that

land. However, the state must pay a fair price for it," Mr. Archer answered.

"Can the state prove that about our marsh?" Tony asked.

"They won't have to prove it if I agree to sell it," Mr. Archer answered. "However, I'm sure someone at the hearing will explain the importance of the highway going through that land."

"What's a hearing?" asked Janet. "I don't understand."

"A hearing is a kind of meeting," explained Mrs. Archer. "The meeting is about a problem. Anyone who wants can go to this meeting. At the meeting people can say what they think about the problem. Many different opinions can be given."

"At all hearings someone or a group of people listen to the arguments. These people then make the decision on how to solve the problem. The problem at this hearing will be where to build the highway. The people who will listen to all of the arguments will be the State Highway Commission," her mother finished.

"So we need to go to the hearing to tell how important the marsh is," said Tony. "The marsh is important too, you know. We learned that . . ."

"Not now," interrupted Mr. Archer. "Maybe we can talk about it this evening. Now I must call Ralph Brewster. When I talked to him this noon I told him a man from the state highway department was coming out to see us this afternoon. Since he's president of the city council, I thought he should know. He said the council had heard plans were being made for the new highway."

"Okay, Dad," said Tony. "That darned old city council," he mumbled to himself.

Mr. Archer went into the study to make his call. The children sat angrily in the living room.

"Now what are we going to do?" cried Janet.

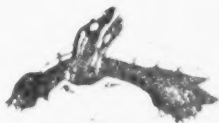
"As soon as Dad is off the phone, I'm going to call Mr. Bronski," said Tony. "Let's see now, what was his first name?"

"I don't remember," answered Janet.

"It's Dean! His name is Dean Bronski," said Tony excitedly.

Mr. Archer came out of the study. "I'm going over to Ralph's," he called to his wife. "We are going to discuss the highway location."

"Okay," Ruth Archer called back.



What Will M.A.N. Do ?

M.A.N.

When the children were sure their father was gone, Tony scooted into the study. Janet stayed in the living room. She pretended to be reading a book. She was really keeping watch so no one would go into the study while Tony was on the phone.

He found the number and dialed. The phone rang several times. "Please be home, Mr. Bronski, please!" Tony whispered worriedly. Then he heard, "Hello."

"Hello," Tony answered. "Is this Mr. Bronski?"

It was. Tony then told Mr. Bronski what he had heard the man from the state highway department say. He also told how his father was still interested in making a profit by selling the marshland.

"Tony, I'm glad you called," Mr. Bronski said. "I'll see what I can do about this. Did you say the hearings begin the first of next month?"

"That's right, Mr. Bronski," Tony answered. "But what can we do?"

"You and Janet sit tight, Tony. I will do the best I can to save the marsh," Mr. Bronski said. "I'm really glad you called me. I will start working on our problem right now."

"Thank you," said Tony in a grateful voice. It made him feel good when Mr. Bronski said "our problem."

They said their goodbyes and hung up. Tony went out to tell Janet about his conversation. Meanwhile, Mr. Bronski dialed the telephone number of a friend.

"Dorothy," began Mr. Bronski. "This is Dean Bronski. I just heard some disturbing news."

"What news?" asked Dorothy Ames.

"The state highway department wants to build a highway through the middle of the marsh on the edge of town."

"Oh, no! They just can't," she exclaimed. Then she asked, "That marshland is privately owned, isn't it?"

"Yes, it is," Mr. Bronski answered. "Fred Archer owns it. His two children have become my friends. They told me about the highway plans."

"Can't the highway be built somewhere else?" she asked in a worried voice.

"There is another possible route. But it's longer and farther away from Cedarville," answered Mr. Bronski. "The hearing to decide the location will be next month. Do you think we can find a group of people who will help us save the marsh?"

"Let's try," answered Dorothy. "I'll start calling around."

"Good. See if those interested can meet at my apartment Wednesday evening at 8 o'clock," said Mr. Bronski.

After the conversation ended, Miss Ames started calling. "There must be at least a dozen people who care about saving the marsh," she said to herself.

That evening after dinner, Tony and Janet tried to explain to their dad how important a marsh is. But somehow they just couldn't make him understand. And Mr. Archer just couldn't make the children understand his side either. During the next week Tony and Janet tried not to worry. They did their school-work. They helped around the house. But their

happy chatter was missing. There were no smiling faces or twinkling eyes.

Mr. Bronski was doing something more than worrying. He was pleased when twelve people came to his home Wednesday evening. He explained the problem to the group.

"So you see," he finished, "we must appear at the first state highway commission hearing next month. The first hearing always has to do with the location of the new highway. The members of the highway commission will decide on the location after that hearing. If we don't appear at that time and explain why the marsh must be saved, the marsh won't be saved. This is our opportunity to show the people of Cedarville what an important job they have to do. The people of Cedarville can ask the highway commission not to destroy this marsh. It is our duty as citizens of Cedarville and of this state to help protect this important wetland."

Everyone agreed. The marsh needed to be protected.

"First I think we should try to explain to all the people of Cedarville just why we want the marsh saved," said Bonnie Henderson.

"That's a good idea," Dorothy said. "We should hold a meeting for all of the citizens of Cedarville."

That would give us a chance to explain the importance of the marsh."

"Good," said Mr. Bronski. "Now, the first thing we must do is divide the work among us. Leon, would you find a place large enough for our meeting?"

"I'll be glad to," answered Mr. Morris.

"We need to tell the citizens of Cedarville about this meeting," Mr. Bronski went on.

"Dorothy is a good artist. She could make posters telling about the importance of the marsh. She could also tell the time and place of our meeting," said Ben Johnson.

"That's fine with me," Dorothy Ames said. "Leon, call me as soon as you have a place." Then, turning to Mr. Bronski, she asked, "What about the date?"

Mr. Bronski and the group discussed what day would be best. They decided on May 19th at 8:00 p.m. That was about two weeks before the hearing.

Then Pat Williams said, "I think we should deliver a leaflet to every family in Cedarville. It should tell them about our meeting, too. Many people might not see the posters."

"Would you write a leaflet and have copies made?" asked Dean Bronski.

"Yes, I will," answered Pat. "I think we should divide the city into parts. Each part should have

a leader who would be sure the leaflets were delivered there."

The group all agreed with Pat. Dean Bronski brought out his city map. Before long the city was divided. While they were deciding who would be the leader for each part, Mr. Bronski said, "I bet Tony, Janet, and their friends would help us. They want to save the marsh, too."

"Good idea, Dean," said Leon. "You can be the leader for that part of the city. They can help you." Then he added, "I think we should give our group a name."

"That's a great idea!" Jim exclaimed.

The whole group thought. They suggested different ideas. None of them seemed to be just right.

"How about Marshes Are Necessary?" asked Bill. "We could shorten it to M.A.N."

"That's very good!" Bonnie exclaimed. And everyone agreed. Then she continued, "We need to get more people to join M.A.N."

"Yes, we should," agreed Mr. Bronski. "It will take many people to save the marsh."

With that the meeting ended. Everyone wanted to get to work.

the city council

The next day Mr. Bronski called Ralph Brewster. "Could I speak to the city council meeting tomorrow?" he asked. "It's about an important problem. The council should be aware of the possibility of a highway going through the Archer marsh."

"I was going to talk about the highway plans myself," said Mr. Brewster. "Isn't Cedarville lucky?"

"What do you mean? How is Cedarville lucky?" Mr. Bronski asked.

"Just think," exclaimed Mr. Brewster, "the highway could be built close to Cedarville. Do you realize how we could profit from the travelers?"

"But, Mr. Brewster," said Dean Bronski, "the highway shouldn't go through the Archer marsh. And I'd like a chance to explain why it shouldn't."

"I guess that's fair. Come to the council meeting in time for lunch," invited Mr. Brewster.

The council meeting went smoothly. As soon as it was over, Mrs. Davis hurried to the Archer house.

"Ruth, do you know some man spoke at the council meeting today against your selling your marsh? Goodness, I don't think he has any business trying to tell

you what to do. Besides, Cedarville could really use the money that travelers on the new highway would bring. It is important that the highway be close enough to our city so the travelers will stop here."

"What man spoke?" asked Mrs. Archer. "What reasons did he give for saving the marsh?"

"His name was Dean Bronski, I think. He is a member of a group called M.A.N., which stands for Marshes Are Necessary. He gave four reasons. First, he said the marsh is an important wetland. And wetlands are one of nature's productive areas. He gave quite a speech on the importance of green plants. He called them producers.

"He also talked about the need for man to watch how a marsh works. He thinks we should learn how all the different members of a marsh community work together. Each member is important. If we understand this we would not keep simplifying everything. We might understand why it is better not to have everything all alike," Helen Davis explained.

"Just a minute, Helen," Ruth interrupted. "I'm not sure I understand."

"I'll try to explain it better. We find ways to make our lives easier and simpler. We all want a perfect lawn, a weedless flower garden, no insects,

lots of houses, and so on. We spray to get rid of unwanted weeds and insects. We cut down wooded lots so we can build houses."

"I see," said Mrs. Archer. "We need to look more closely at nature. Then we would see how all the different plants and animals need one another."

"That's what he said. A community needs many different members working together. The dragonflies that have their offspring in that buggy land of yours eat mosquitoes! Did you know that?"

Mrs. Davis went right on without waiting for an answer. "His third reason for saving the marsh had to do with the plants and animals living there. The marsh is the habitat for certain kinds of animals. If you take plants or animals away from their habitat, they probably won't survive. Great blue herons, muskrats, redwing blackbirds, cattails, reeds, and others must live in a soggy, marshy area. A marsh gives them the kinds of protection and foods they need. They would die out without this proper habitat. Migrating waterfowl like ducks and geese also need the marsh. They rest in it. And more important, they nest in it. These waterfowl could die out if they didn't have a protected area for nesting."

"Those sound like good reasons to me," said Mrs. Archer.

"Well, let me finish and then I'll tell you what I think," said Mrs. Davis.

"Okay, I'll keep quiet," Mrs. Archer promised.

"Mr. Bronski said the lake itself was the fourth reason for saving the marsh. If all of the marshes around Silver Lake are destroyed, Silver Lake will change. It seems that marshes trap many of the nutrients that could be carried into Silver Lake. Marshes keep the lake from being overfed. Many living things in the lake would die if it were overfed."

"Why?" asked Mrs. Archer.

"Let me see if I kept the list he wrote on the chalkboard for us. It helped explain the problem." Mrs. Davis started emptying her purse. She really needed a briefcase to help her keep track of all her papers. "Oh, here it is. Why don't you just read it," suggested Helen.

So Mrs. Archer read.

1. As streams flow toward the lake they carry leaves, dead animals, and other materials.
2. The dead animal and plant parts will be decomposed.
3. If all of the materials are decomposed in the lake, their nutrients will be added to its soil and water.

4. Too many nutrients in the lake increases the green plant population. Green plants like algae grow and fill the lake.
5. The process of decomposition uses oxygen.
6. Fish and other aquatic animals also need oxygen.
7. If too much decomposition takes place in the lake, it will use up the oxygen supply.
8. Without enough oxygen many kinds of fish and other animals will die.

"Mr. Bronski certainly gave good reasons for keeping the marsh," Ruth said when she finished reading.

"Even so," interrupted Mrs. Davis, "I'm not sure if all of this nature stuff is as important as the money Cedarville would get if the highway were close by. And besides, there are several marshes around Silver Lake. The lake would live if we took just this one marsh."

Tony and Janet had come in during Helen's explanation of the council meeting. They decided not to cause an argument so they went right upstairs to do their homework. "Of course," said Janet, "nature is more important than money for Cedarville. Tony, what did Mrs. Davis mean when she talked about habitats?"

"A habitat is where living things live," answered Tony.

"Is our house the habitat for us?" she asked.

"No, a habitat is more than just a house. It means all of the space needed to feed, protect, and house a kind of living thing," Tony told her. "That means the space needed to grow our food, too. And we can't grow all our food in the house."

"Is Cedarville our habitat?" Janet asked.

"No," answered Tony. "There is space enough to house us. But again, there is not space enough to grow our food. There is also not space enough to grow the trees used in making our house. And we need metals and fuels from outside of Cedarville. I think the earth is our habitat. Man lives all over the world."

"Gee, people have a big habitat," Janet said. "How about the marsh? Is the marsh the muskrats' habitat?"

"Yes, the habitat for muskrats is the marsh. There's room for their houses. And there's plenty of food for them in the marsh. Without its habitat the muskrat family would not survive. You do know what survive means, don't you?" Tony asked his sister.

"Yes," answered Janet. "It means to live."

"Now do you understand?" asked Tony.

"I think I do," answered Janet. "Building a highway through our marsh would ruin the muskrats' habitat. It would also ruin the habitat for other kinds of plants and animals living in the marsh. Some might even die out. That would really upset the marsh community."

"I think you've got it," said a relieved Tony.

While the children were talking upstairs, Mrs. Davis was still talking to their mother downstairs. Mrs. Davis was saying, "After Mr. Bronski sat down, Ralph Brewster stood up and told the other side of the disagreement."

"What did he say?" asked Mrs. Archer.

"What he said made a lot of sense, that's for sure!" exclaimed Helen. "You know Cedarville needs to grow. It's just like anything else. Cedarville must grow to stay alive. Money coming into a city helps it grow."

"Do you think the new highway will bring money into Cedarville?" asked Mrs. Archer.

"Yes, I think it will," answered Mrs. Davis.

"However, the highway must be close to our city if we are to profit. It must be close enough to bring in

travelers. Travelers have to find places to eat, sleep, buy gasoline, and shop. These things cost money. Cedarville could use this money."

"Would the highway have to go through the marsh for it to be close enough?" Mrs. Archer asked.

"I'm afraid so," answered Helen Davis. "If the highway doesn't go through your marsh, it must go on the other side of the hills. That would swing the highway so far north that travelers wouldn't want to stop here. It would be too far out of their way. Besides, the land over there is good farmland. We should put a highway through land not so valuable."

"Helen, please explain to me why Cedarville must grow," Ruth Archer asked. "I like our city the way it is."

"Cedarville is a nice place," agreed Helen. "But a city must grow or it may die. You don't want Cedarville to die, do you? To stay alive we need new people with new ideas. They must want to come to our city."

"How does this help?" asked Ruth.

"A new company or business needs people to buy its products. Travelers buy. The more people buy, the more money the business will make. These profits let the business grow. Then it can hire more people.

These jobs can keep young people here and bring in others. When other companies hear what a great city Cedarville is, they too will want to move here. Again, there are more jobs. Working people spend money. This keeps the city growing."

"Can't the city grow in another way?" Mrs. Archer asked. "Maybe some cities like Cedarville are big enough already. The larger you get, the more problems you have. Why just look at New York City!"

"Now you sound just like Mr. Bronski," laughed Mrs. Davis. "Money makes a city grow. And Cedarville must grow. We need a way to get more money into Cedarville."

"But do you have to ruin our marsh?" Mrs. Archer questioned.

"I'm afraid so, Ruth," she answered. "It's the only way. This is such a good chance for Cedarville. We must not miss it." Then looking at her watch she exclaimed, "Goodness, I must get home!" With that Mrs. Davis left in a hurry.

Tony and Janet help

Time went slowly for Tony and Janet. Each day seemed to take forever. But for the members of M.A.N.,

the time went quickly. When Leon Morris tried to find a meeting place, he ran into trouble.

"It's like this," he told Mr. Bronski. "The high school doesn't want outside groups to use their auditorium. The Community Center is busy that night. Where should I try next?"

Mr. Bronski suggested several places. Leon called each one. Finally, the last place he called said it was all right. So he hurriedly called Miss Ames.

"Dorothy," Mr. Morris said. "The YMCA said we could use one of their big meeting rooms."

"Thanks, Leon," said Dorothy Ames. "I was beginning to wonder if we could find a room. The posters are finished except for writing in the meeting place. Did you call Pat?" she asked. "He will need this information for the leaflets. Did you get a room number at the 'Y'?"

"No, I didn't. They said the room number will be posted in the lobby," he answered. "I'll call Pat right now."

Pat Williams was relieved when Leon called. He also had been worried. But now that he knew the meeting place, he could finish the leaflets. He could also ask the newspapers to announce the meeting time and place.

On May 16th, three days before the public meeting, Mr. Williams delivered a bundle of leaflets to each group leader. "Be sure these are delivered no later than tomorrow," he said to each leader. "I'm sorry to be so late in getting the leaflets to you. It seems Leon had a hard time finding a meeting place."

Tony and Janet were delighted when Mr. Bronski asked them to help.

"Of course we'll deliver leaflets to every house in our neighborhood," answered Tony.

Tony called Chuck and Bob. "Do you want to help us deliver leaflets?" he asked.

"What leaflets are you talking about?" Chuck asked.

"Mr. Bronski and his friends in M.A.N. are trying to help save the marsh. They want everyone in Cedarville to understand what could happen if the highway goes through the marsh. They'll explain it all at a public meeting. These leaflets tell about it," Tony explained.

"Sure, I'd like to help," Chuck said.

Janet also called two of her friends. It didn't take long for the six of them to deliver the leaflets to everyone in their neighborhood.

This is what the leaflet looked like. —————>

Cedarville

Do you want to keep Silver Lake alive?

Do you want to save a place for migrating ducks
and geese?

Do you want to save one of nature's most productive
areas?

If you do, please attend

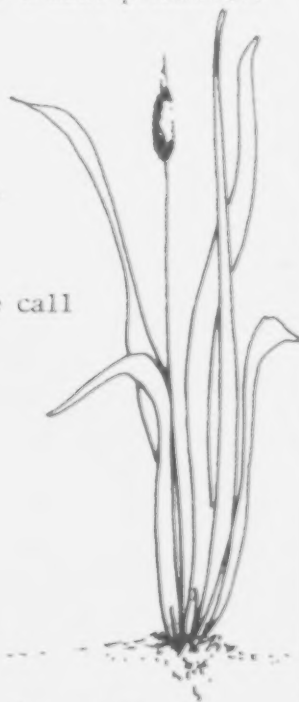
A Public Meeting

May 19 8:00 P.M.

Y.M.C.A.

If you have any questions, please call

M.A.N.* 296-0453



*Marshes Are Necessary

Paid for by M.A.N., Dean Bronski, Secretary

With that job finished the children grew restless again.

"Now what can we do?" asked Meg.

"I don't know," answered Janet.

Tony and Janet had a hard time trying to help save the marsh. But there just wasn't much kids could do. Mr. Archer wanted to sell the land to the state. He couldn't understand why the children hoped to save it. The marsh just wasn't as important as the profit he could make by selling the land.

The marsh itself helped the restless children wait for the hearing. They spent hours sitting and watching. They watched new mallard families swim proudly in a small open space of water. They watched muskrats busily cutting cattails. They watched mayflies and other insects fly from plant to plant as if they had lost something.



Some days their friends sat and watched with them. Most of the time, there were six worried faces.

"Tony," Janet would ask, "do you really think we'll lose our marsh?"

"I don't know, Janet," he would answer. "Some days I'm sure Dad and the city council will win. Other days I'm sure Mr. Bronski and M.A.N. will win."

Not many citizens of Cedarville came to M.A.N.'s meeting. The members of M.A.N. were rather disappointed.

"Maybe I should have made more posters. Perhaps ten weren't enough," Dorothy Ames said.

"If I had found a meeting room sooner, we could have put more ads in the newspaper," said Mr. Morris sadly.

"At least we tried to explain the importance of the marsh," said Mr. Bronski. "Now we must be sure to present a clear argument at the hearing."

The members of M.A.N. decided that Dean Bronski should speak at the hearing. The rest of the members of M.A.N. would attend with him. This would show that many people agreed with Mr. Bronski.



What Will Man Do ?

plan 1

The day of the hearing finally arrived. Janet and Tony wanted to go.

"Please, Mom," begged Tony. "Can't we go?"

"Please, Mommy, please," said Janet in a begging voice.

"It's all right with me. Go ask your father," Mrs. Archer answered.

At first Mr. Archer said, "No."

But Tony pointed out, "It's our chance to see how our government really works. We could see a real hearing. Besides, we care about the marsh."

Mr. Archer thought a minute. It just might be a good experience for them. "Okay, you may go. But you must keep quiet."

Tony and Janet were surprised when they walked into the hearing room. There were only about forty people. The children had thought many more people would care enough about the marsh to come. They waved to Mr. Bronski. He was sitting with ten other members of M.A.N. The children also saw Mr. Brewster with several men they didn't know. The children sat down and waited for things to begin.

Soon a group of men and women came in and sat down at the tables in the front of the room. A lady sat at a little machine that looked like an adding machine.

"Why does she need an adding machine?" asked Janet.

"That's not an adding machine. It is a Stenograph machine," answered her mother quietly. "It works much like a typewriter. That lady is a secretary. She will record everything that is said here today."

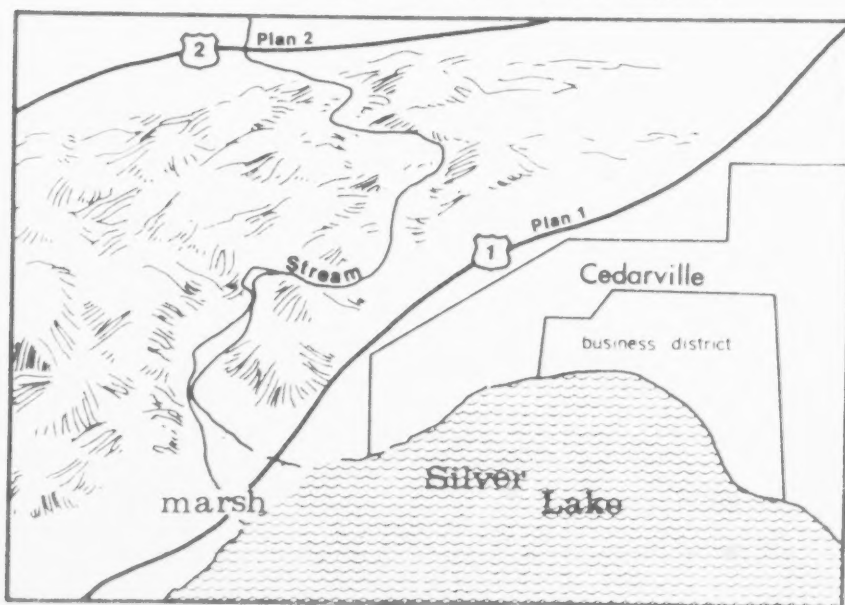
"Oh," whispered Janet. "Who is that man getting ready to speak?"

"He is Mr. Nelson, the state highway commissioner. He is the head of the state highway commission. Those other people are also members of the commission. They are the people who will decide where the highway will go," Mrs. Archer explained.

Then Mr. Nelson said, "I now open this hearing for discussion regarding the proposed highway from Nellington to Hammersly. The question to be discussed at this hearing is the route the highway will take from Nellington to Hammersly. First, I would like Mr. Monahan, one of our highway engineers, to explain the two possible routes."

Mr. Monahan walked to a bulletin board displaying this map.

"You will notice that Plan 1 would route the highway directly from Nellington to Hammersly. It would cut across this marsh," he said, pointing out the marsh on the map, "and pass by the edge of



Cedarville. Plan 2, on the other hand, takes the highway north of these hills. It then swings down toward Hammersly several miles east of Cedarville. Our tests show that these hills are almost solid rock," he said, pointing to them. "That is the reason the highway would have to swing so far north. It would be difficult to route a highway through the rock."

"Which location is the better one as far as you are concerned?" asked Mr. Nelson.

"We think Plan 1 is the better one," Mr. Monahan answered. "It's a much more direct route. And it goes through land that is not good for farming or much else. The Plan 2 route is longer. And it routes the highway through land that is valuable for farming. It would cost us more to build a longer route and to buy more valuable land."

"Thank you, Mr. Monahan." Then Mr. Nelson went on, "At this time we will hear any arguments for the adoption of Plan 1."

Mr. Brewster stood up and said, "Mr. Nelson, gentlemen, ladies, as president of Cedarville City Council, I would like to present our argument for Plan 1.

"Cedarville is a fine community. It offers its citizens good schools, a fine university, recreational facilities, good stores, and great people. But for

any city to stay alive it must grow. If Plan 1 is chosen, the highway would bring travelers to Cedarville. Travelers would bring money into Cedarville. We all know that people on the go must eat, sleep, and relax. Why, do you realize how much each of them spends each day? The state told me that each traveler spends about \$27 a day. We the people of Cedarville want this money spent in our city. It will help our businesses to grow. Growing businesses will have more jobs to offer. New businesses will want to move to Cedarville. Again more jobs will be open. Those jobs will help keep our young people here. They will also bring more people to our city. Cedarville will grow.

"Plan 1 will also help solve Cedarville's traffic problem," Mr. Brewster continued. "No one likes our crowded streets. This crowding slows traffic. And more accidents happen when there is so much traffic. Plan 1 will allow travel to be faster and safer. Also the noise and dirt from heavy traffic will be taken out of the middle of the city."

"I'm speaking for all of the people of Cedarville now . . ."

That did it. Leon Morris had heard enough. "Mr. Brewster, you are not speaking for all of the people of Cedarville!"

"That's right. You are not speaking for all

of us!" Dorothy added.

"Mr. Nelson, may I continue?" asked Mr. Brewster, a little upset by the interruption.

Tony and Janet sat wide-eyed. "I thought everyone was supposed to keep quiet," whispered Janet.

"Maybe that rule is only for kids," said Tony. "Look, no one is listening to Mr. Brewster."

"Will everyone please listen to Mr. Brewster now," said Mr. Nelson. "You will each get a chance to speak soon."

The room started to become quiet.

Mr. Brewster began once more. "The city council, your elected officials of Cedarville, feel that Cedarville can profit in two ways if Plan 1 is chosen. First, we know that Cedarville must grow. Plan 1 will help us grow. Secondly, we all agree that our city needs a solution to its traffic problem. Plan 1 gives us a good solution. Therefore, Cedarville wants Plan 1 to be chosen. Thank you." Mr. Brewster then sat down.

"Does anyone else want to speak in favor of Plan 1?" asked Mr. Nelson.

A man stood up. "My name is Herbert Snidt. I'm in favor of Plan 1 because Plan 2 would put the highway through good farmland. This land," he said, pointing to the land around Plan 2, "belongs to the

Swensons, Johannsons, Browns, and Smidts. We are good farmers. You should think about what you'd be doing if you put a highway through our farms. You would be ruining land that is worth much more than the marsh in the middle of Mr. Archer's land. These farms grow food for all of us to eat."

Then Mr. Smidt sat down. Mr. Nelson asked again if anyone wanted to speak for Plan 1.

plan 2

The room was silent.

"Does anyone wish to speak in favor of Plan 2?" he asked.

Mr. Bronski stood up. Tony and Janet sat up tall. "Now the commissioners will hear why Plan 1 is no good," the children thought.

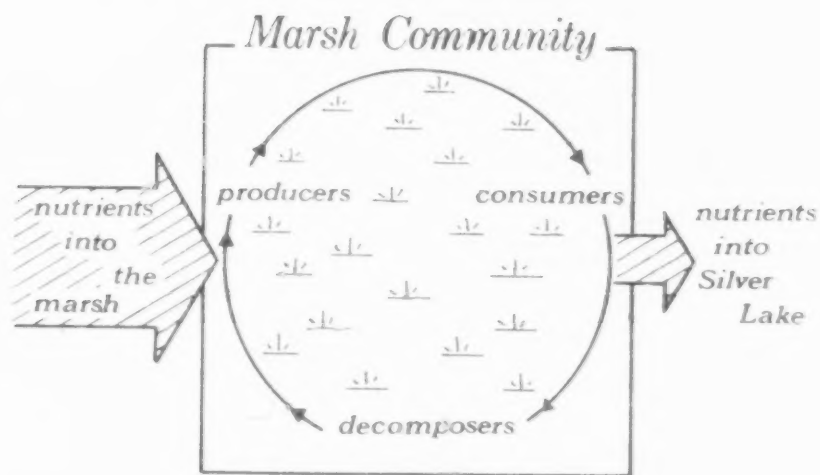
"Mr. Chairman, commissioners, councilmen, and interested citizens of Cedarville, I am Dean Bronski, professor of biology at the university," Mr. Bronski began. "Mr. Brewster explained very well why some people of Cedarville want Plan 1. But all of Cedarville do not agree. I would like to explain why some of us do not want Plan 1 chosen. I am speaking for a group called M.A.N. Those letters stand for Marshes Are Necessary. We would like to give you

one reason for not choosing Plan 1. That reason is the Archer marsh. You all should understand what will happen if the highway is routed according to Plan 1. The marsh would be filled in. It may be just a soggy worthless piece of land to you now. But when I finish I hope you will understand its importance. Silver Lake will not stay the same without the marsh."

"Oh, come on!" exclaimed Ted Smith loudly.

"It's true," Mr. Bronski went on. "This marsh helps keep the lake from being overfed. You see," he explained, "the stream carries many materials containing nutrients as it flows toward the lake. When the flow reaches the marsh, it slows down. This causes most of the nutrient-filled materials to be dumped in the marsh. Many of those nutrients then stay in the marsh. Only some of them are carried directly into the lake.

"Here is a simple drawing of the stream, the marsh, and Silver Lake," he said, holding it up for everyone to see. "The nutrient-filled materials are carried down the stream toward the lake. Now if we remove the marsh and straighten out the stream, all of the nutrients would go directly into Silver Lake. The lake will be overfed if it gets all of these



nutrients. This will cause an overgrowth of green plants. I'm sure you don't want your beautiful lake filled with algae and scum.

"The oxygen supply is another problem when there are too many nutrients in a lake. During the process of decomposition two things are happening. One, the nutrients from the material being decomposed are released. Two, oxygen is used. If too many materials must be decomposed, the oxygen supply will be used up. Then many fish and other aquatic life die. Silver Lake will not stay the same."

Then Mr. Brewster jumped to his feet. "Filling in one marsh won't really hurt the lake!"

"You're right," said Mr. Bronski. "Filling in one of Silver Lake's marshes wouldn't hurt the lake too much. But in the last twenty-five years we've lost over half of Silver Lake's marshes. The golf course was once a marsh. The homes on the east side of the lake are built on a filled-in marsh. The lake will change if we continue to fill in all of them," answered Mr. Bronski.

Then he went on, "Marshes are just one kind of wetland. Wetlands have been in our state for hundreds of years. But in the last seventy-five years we've destroyed over one-half of them. We must stop this!" Mr. Bronski exclaimed.

The room was quiet. The children hoped no one else would interrupt Mr. Bronski. They also hoped everyone was listening carefully.

"The marsh is also important to the animals and plants living there," Mr. Bronski continued. "Some of them will not survive without the marsh. These plants and animals are adapted to the marsh. They cannot live in a field, forest, or concrete highway.

"The fishermen will miss the marsh. Many kinds of fish they want to catch can't live in a lake without much oxygen. These fish need a lot of oxygen to survive.

"The hunters of the area will soon miss the marsh. The migrating ducks and geese will fly new routes if their resting places are destroyed. In fact, many waterfowl will have a hard time surviving if we destroy all of our marshes. These birds need the protected areas for nesting.

"Finally, I would like to explain to you how this marsh, other marshes, and all wetlands are some of nature's most productive areas. As you know, green plants are the only living things that can capture the sun's energy. All animals, even man, need green plants to give them this energy. Without it no animal could survive.

"A great many green plants can grow in the marsh. They can grow there because the marsh's water is shallow and because the marsh is always being fed many nutrients. The energy captured by these marsh plants is passed from them to consumers. Man is one such consumer. If we replace the green plants of the marsh with the concrete of the highway, we will lose the Archer marsh as a source of energy.

"So you can see, ladies and gentlemen, the Archer marsh is not so worthless after all. All wetlands, in fact, are valuable. We must not destroy another one of nature's productive areas. Perhaps our own

survival is our profit when we work with nature."

Tony and Janet almost clapped. They were so proud to be Mr. Bronski's friends. But when the children looked around they saw faces that weren't smiling. "Could there still be people who think that less city traffic and the growth of Cedarville are more important?" wondered Tony.

Mr. Nelson stood up. "Thank you gentlemen for presenting your arguments so well. Would you give us your written reports now?"

Mr. Brewster and Mr. Bronski walked to the table and handed Mr. Nelson their reports.

"You have given this commission many things to think about before we choose a route for the highway. We will have to think about what each of you has said. These written reports will help answer any questions we might have. After we've carefully considered each side of this disagreement we will decide where the highway should be built. We will let you know when we've made that decision. This hearing is now over."

Tony and Janet left with their parents. No one did much talking.

"How do you think the members of the commission will decide, Tony?" asked Janet.

"I don't know," he answered. "I just don't know. But I'm beginning to wonder if we really need a new highway at all."



ED 068366

Adaptation and Habitat



Name: _____

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ADAPTATION AND HABITAT

What you will study

Habitats

Adaptation

Special characteristics of animals

What you should be able to do

1. Think of characteristics that an animal might have if it lived in an imaginary habitat.
2. Draw a picture of your animal having the adaptation you gave it.
3. Tell why the adaptation you gave your animal fits the imaginary habitat.
4. Name some animals with the same adaptations that you gave your animal.

5. Name some animals and their adaptations.

What you need to know

The places where animals live are called their habitats. Animals always seem to fit their habitats well. They have special features which let them fit their habitats (and plants do too). These special features are known as adaptations. An example is the gills of a fish. A fish's habitat is water. Its gills are an adaptation to its water habitat. Gills let a fish get oxygen from its water habitat. Another example is the bill of a woodpecker. Its habitat is a wooded area. The woodpecker's bill is long, sturdy, and pointed. Its bill is adapted for getting insects living in trees.

What you need

activity packet and pencil

What you should do

Below is a description of an imaginary (make-believe) habitat. No habitat like it can be found in nature. You are to read about this habitat. Then think of adaptations that an animal would need to live there. It will not be a real animal because it is not a real habitat. Write a description of your animal. Give it a name if you like. Draw a picture of it showing the adaptations you have given it.

Later you will have to tell why you made your animal as you did. Remember, this is an imaginary animal, so use your imagination.

Imaginary Habitat

Your imaginary animal lives in a woodland. Although it rains pretty often, there is no stream in the woodland. Only small puddles are present, and they dry up in the hot months of summer. In winter, snow falls but usually melts soon after falling. The main food of your animal

is hard-shelled nuts. These nuts do not normally drop from the trees. They have to be gathered from the upper limbs by the animal. Your animal is eaten by two other animals. One of these animals is a bird which glides silently above the trees during the day while your animal gathers food. The other animal is a weasel-like animal that goes out and looks for your animal while it rests at night.

1. Describe your animal to someone else.
2. Show them the picture you drew.
3. Tell them why your animal is able to fit into the imaginary habitat.
4. Compare the animal you made with those of your classmates.

If you like doing this, have a game with some of your classmates.

You write an imaginary habitat and have them make an animal to fit it. See how close they come to an imaginary animal that you had in mind.

You can also turn this activity around. Imagine an animal first and think up a habitat to fit it.

You can also use real animals and real habitats instead of make-believe ones.

Questions to answer

Did your classmates' animals have different adaptations than yours?

Were there any adaptations they thought of that were the same as yours?

What animals in nature have adaptations like those you gave your animal?

Questions to think about

Look at a picture of an animal called a duckbill platypus. Read about its habitat. Does nature have a better imagination than you? (The Life Nature Book Evolution has a good picture of a duckbill platypus on pages 60-61. Also, most encyclopedias have such pictures.)

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Community-1



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Center No. C-03/Contract OE 5-10-54

COMMUNITY -1

What you will study

Community

What you should be able to do

1. Set up an ant farm.
2. Tell what ants do in their community.
3. Tell how the ants work together to make a successful community.
4. Decide why you are or are not a member of the ant community.

What you need to know

Most communities in nature are very complicated. This is because many different plants and animals are working together. In nature, you seldom find a community with just one kind of animal or plant.

You can set up a simple community with only one type of living thing--ants. An ant farm community allows you to watch easily how the ants work together. Although it may seem to be a complicated community, it is much simpler than a community like you find in a marsh, desert, old field, or woods.

What you need

- | | |
|-----------------|------------------|
| 1. an ant farm | 4. sand |
| 2. live ants | 5. peanut butter |
| 3. masking tape | |

Ant farms can often be bought in a variety or pet store. They can also be ordered through catalogues.

They can also be easily built using two pieces of glass and three grooved boards to support the glass.

Live ants can be bought or collected. It will be best to collect your own ants. However, the time of year will determine

whether or not you can do so. If you do collect your own, make sure they are all from the same ant hill. When ants from two different hills are mixed, they generally fight with each other. Do not tear up an ant hill any more than necessary to collect your ants.

What you should do

1. Fill the space between the glass panes of an ant farm two-thirds full with sand.
2. Add enough water to moisten the top inch of the sand. Add water as needed to keep the top inch moist.
3. Put 15-20 ants into the ant farm. Be careful not to harm them.
4. Add some food to the top of the sand. A teaspoon of peanut butter will do nicely. Refill as needed.

5. Seal the top with masking tape. Leave a small hole for air to move in and out.
6. Watch the ant farm each day for at least a month. Look for ways in which the ants work together to make tunnels. Write down everything you see on the blank pages at the end of this activity. Sketch each day the tunnels that are built.

Questions to answer

How do the ants work together to make a successful community?

Does each ant work alone, or do several work together?

Could one ant get along without the help of other ants?

Are you a member of the ant community? Why or why not?

Questions to think about

Can the human community get along without its members helping one another?

Does the human community need the help of other living things?

Is the human community simple or complicated compared to the ant community?

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Community-2



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Center No. C-03/Contract OE 5-10-54

COMMUNITY-2

What you will study

A water community

What you should be able to do

1. Make a microcosm (a "little world").
2. Tell what happens in the microcosm.
3. Show how the different members of the community need each other.

What you need to know

A community is the plants and animals living together in a certain place. You can make a water community very easily in an aquarium. This water community is open to the air. Water, food, nutrients, and sometimes air are added every few days to the aquarium.

In this activity, you will make a water community that is closed to the air. Such a community is called a microcosm which means "little world." Water, food, nutrients, and air are never added once a microcosm is made. The only things which can get in or out of it are light and heat.

What you need

1. a large glass jar or jug with a cap or cover (a gallon cider, vinegar, or syrup jar is excellent)
2. sand, or small-sized gravel
3. 1-2 guppies
2-3 snails
(These can be bought cheaply at any pet store.)
4. several branches of water plants--the best plant is the common aquarium plant called Elodea
(It too can be bought at any pet store.)

5. one gallon of pond water--if pond water is not around, lake, marsh, stream, or river water will work
6. optional--paraffin or wax, and a way to melt it

What you should do

1. Get everything together to make your "little world."
2. Clean out your jug with soap and water. Then rinse it very well. (If you leave any soap inside, it can kill your fish and snails.)
3. Cover the bottom of the jug with a half inch of sand or gravel.
4. Fill the jug about three-fourths full with your pond, lake, marsh, stream, or river water. Water from faucets will not work. It often contains chemicals which will kill the guppies or snails.

5. Let the water in the jug stand overnight. This allows the sand and gravel to settle. Also, the water temperature will rise to room temperature. This way the guppies and snails will not be "shocked" by being put into cold water.
6. After letting the water stand, add 1 or 2 guppies, 2 or 3 snails, and 3 or 4 branches of water plants. Any more living material than this will be too much for a gallon jug.
7. Stopper the jug and seal tightly.
8. If you want to be sure that air or water will not get in or out of your microcosm, you can seal the top with melted paraffin or wax. (It is not necessary to do so if the cap fits tightly.) Pour the melted paraffin over the top of the cap so that the cap is completely covered. You can

pick the paraffin from the sides of the jug after it cools. Be careful not to burn yourself if you do this. You may need help from your teacher or parents.

9. Set the "little world" by a sunlit window.
10. Watch your microcosm every day for at least two weeks. Write down what you see each day. Some things you should watch for and write down are:
 - a. Is the water clear or cloudy?
 - b. Where do oxygen bubbles form in your microcosm?
 - c. Do the plants get bigger, smaller, or stay the same?
 - d. Do the animals get bigger, smaller, or stay the same?
 - e. Do any animals or plants die?
 - f. Where do the guppies spend most of their time?
 - g. Where do the snails spend most of their time?
 - h. What do the guppies eat?

- i. What do the snails eat?
- j. Do any plants or animals appear that you did not put in?
- k. Anything else you see of interest should be written down.

Questions to answer

Is each member of the "little world" community important? How?

Why do the guppies need the plants?

Do the plants need the guppies or snails to live?

Why are the snails important?

Is the community the same after a month as it was at the beginning?

Where do the plants get nutrients to make food?

If any plants or animals appeared that you did not put in,
where did they come from?

Questions to think about

How is your "little world" like the "big world"?

How is it different?

Other things to do

If you like studying this community, you can try other ways to
make a microcosm. Use different plants and animals than guppies and
Elodea. Pet stores usually have many different kinds of fish and
water plants.

You might also make some communities open to the air. An
aquarium is the most usual type.

Land communities can also be set up in a glass box called a terrarium. You will find another activity in this packet about terrariums.

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Community-3



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Center No. C-03/Contract OE 5-10-54

COMMUNITY-3

What you will study

A land community

What you should be able to do

1. Make a land community in a terrarium.
2. Find in your community examples of:
 - a. producers
 - b. consumers
 - c. decomposition
 - d. food chains
 - e. habitats
 - f. adaptations
3. Tell how the above examples are important in the community.
4. Tell if you think nutrients or decomposers are important in the community.

5. Tell how the terrarium is like and different from your own community.
6. Predict what would happen if certain parts of the community were changed.

What you need to know

You are to make a land community in a type of glass aquarium called a terrarium. A terrarium is any glass container that can be sealed to hold a small land community. It normally has water, soil, air, plants, and animals in it.

What you need

a terrarium

It is possible to buy terrariums. School supply catalogues will show you where you can buy very nice terrariums. Flower shops sell fancy ones.

An aquarium can easily be changed into a terrarium. All that is needed is a piece of glass to cover the open top.

A gallon jar with a wide mouth can also be used as a terrarium. Mayonnaise, potato salad, pickles, relish, and paste often come in such jars. The mouth of the jar must be big enough to stick your hand through. To make such a jar into a terrarium, it is tipped on its side. Some kind of stand should be used to keep it from rolling.

What you should do

Before you do this activity, you should do some of the other activities first. Try at least to start an activity about producers and consumers, decomposers and decomposition, nutrients, food chains, habitats, and adaptations. By doing them first, you will enjoy your terrarium more and learn more from it.

You can make almost any type of community you wish. The first step is to collect some soil and the plants growing on it. Any animals that you find living where you collect your soil and plants should be included. If everything you collect for your terrarium comes from one spot, you have a better chance of making a good terrarium. Since the plants and animals live naturally together, they should live well together in a terrarium.

You can get your community from a woods, an open field, a desert, a park, a prairie, or any other place. It all depends on where you live and what you want to do.

Terrariums can be made to be wet or dry. Plants which live well in a wet terrarium community are ferns and mosses. Plants which live well in a dry terrarium are cacti and sage.

You have to be careful not to put too many animals in your terrarium. Only one or two very large ones should be included.

Animals that live well in a wet terrarium are frogs, insects, insect larvae, worms, snails, and turtles. Animals that live well in a dry terrarium are insects, lizards, and some non-poisonous snakes.

When making the terrarium, put the soil and plants in first. Water them if necessary. Put any animals in that you wish to include. Close any openings through which an animal might escape. It is not necessary to leave any air holes.

Your terrarium community will pretty much take care of itself. You may need to water it once in awhile. Hopefully, food for any animals will already be in the terrarium in the soil and plants.

When you have finished your terrarium, set it by a window. Watch it very carefully for at least a month. Every day write down what you see happening. Watch for changes and write them down. Keep watching for at least a month.

Some things you should watch for and write down are:

1. Where do the animals spend their time?
2. What do the animals eat?
3. Does anything die?
4. Do the plants get bigger, smaller, or stay the same?
5. Do the animals get bigger, smaller, or stay the same?
6. How do different members of the community affect each other?
7. Anything else of interest that you see should be written down.

Questions to answer

What producers are in your terrarium community?

How are they important?

What consumers are in your community?

How are they important?

Did you find anything decomposing in the community? What?

Are there decomposers in the community?

How are they important?

What food chains were present in the community? Draw them.

What were the habitats of the different animals?

Were the animals' habitats the whole terrarium or just part of it?

What adaptations did any of the plants or animals have?

How did they help the members of the community live there?

Were nutrients important in the community? How?

How is the terrarium community like man's communities?

How is it different?

Questions to think about

What would happen if you overcrowded the terrarium by putting in too many animals?

What would happen if you polluted the air in the terrarium with smoke every day?

What would happen if the water in your terrarium became polluted?

What would happen if the part of the terrarium where the animals live were changed to cement?

What would happen if it were always noisy around your terrarium?

How do your answers to the last five questions have anything to do with you and where you live?

Follow-up

Maybe you would like to find out the answers to the last six questions. To do so, you will need two terrariums, both alike. You leave one alone while you experiment with the other. Compare the two to see what changes occur.

To test overcrowding, put twice as many animals in the terrarium than you did at first.

You could let a candle burn for 5-10 minutes in one terrarium each day to pollute the air.

Use salt water instead of pure water to see how polluted water affects your community.

Change the part of the terrarium where the animals stay by putting in bricks.

To see what noise does, play a radio all day in or beside the terrarium.

Maybe you can think of other tests to do.

ED 068366

Consumers

Raccoon Tracks



Mink Tracks



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Center No. C-03/Contract OE 5-10-54

CONSUMERS

What you will study

Consumers

What you should be able to do

1. Find tracks of consumers which live in marshes and other places.
2. Make plaster-of-Paris casts of animals' footprints.
3. Try to identify animals (consumers) by the tracks they make.

What you need to know

When you visit a marsh, a woods, a lake, a park, or a river, it is easy to find the producers. Plants do not move around. They are easy to see. The consumers, or animals, are much harder to see. They see you before you see them, and they hide. Or they often sleep during the day.

Consumers, however, often leave clues that let you know they are around. An animal leaves its tracks as it walks in any place that is muddy. Places to look for these tracks include marshes, woods, parks, lakes, or rivers. After a rain, good tracks can be found almost anywhere. The consumers can be identified by their footprints.

What you need

- | | |
|-----------------------------------|---------------------------|
| 1. a round, plastic bleach bottle | 6. a bottle of water |
| 2. plaster-of-Paris | 7. a spray can of shellac |
| 3. vaseline | (optional) |
| 4. a coffee can | 8. fine sandpaper |
| 5. a small tin can | 9. dark paint |
| | 10. paintbrush |

What you should do

Be a detective and try to find which consumers live in a certain area. Your clues will be the footprints they leave behind.

First, gather your evidence by going to a place to explore for footprints. A marsh is a very good place to look for them. Rivers, lakes, parks, and forests are also good. Other places can also be used. For other suggestions besides these places, see Other ways to do this activity in the last section.

The easiest type of tracks to find are those made by the larger animals. But smaller animals like birds, frogs, and even insects can leave footprints. The more you look, the more you will find. (You had better wear old clothes for this activity.)

After you have found some clues (footprints), make plaster-of-Paris casts of the tracks following the directions below. You will do this outside. The cast you make will show the shape

of the animal's foot. If you want a cast that looks like the original track which was sunk into the mud, you will have to make a second cast using the first. You can do this at school or at home. Remember, the first cast looks like the animal's foot. The second cast looks like the animal's footprint.

Try to find out as well as you can which consumers the tracks belong to. A book that can help you is Murie's A Field Guide to Animal Tracks. Many other books are written about animal tracks and can be found in your school library or the city library.

Method for making plaster-of-Paris molds:

1. Clean the rocks and twigs from the tracks you have found.
2. If you can, spray the tracks with some shellac (varnish) from a spray can.
3. Place a shallow, smooth-walled, plastic container around the tracks. (A bleach bottle with its top and bottom cut off will be good for this.)

4. Press the plastic container into the soil an inch or two. If you put vaseline on the inside of the plastic cylinder, your cast will push out easier.
5. Mix, then pour enough plaster-of-Paris to fill the track and cover the inside of the plastic container about two inches above the track. (Carry an old coffee can to mix the plaster in. You should also carry a bottle of water to use with the plaster. Use a stick to mix it.) The mixture should be about as thick as heavy cream.
6. Let the plaster-of-Paris harden for at least 15 minutes. (If the air is hot and dry, this is probably long enough. If it is wet, you will have to wait longer.)
7. When the cast is dry, lift it out. Store it for safe-keeping until you are ready to leave.

8. At home or school, clean the cast of mud by rinsing it with water.
9. Use your cast to make a reverse mold. (You have to do it twice, remember, to get a mold that looks like the track.) Put a thin layer of vaseline on the cast. Place the plastic container around it. Repeat steps 4-7.
10. If you wish, rough spots can be sanded with fine sandpaper. The track will show up better if you paint the sunken-in tracks with dark paint.

Questions to answer

What consumers did you find living in the area you looked at?
Were there some you could not identify?

Do you think other consumers live there besides those you found tracks for?

Questions to think about

What other clues could a detective look for besides tracks to find out which consumers live in a certain area?

Other ways to do this activity

You can look for consumers almost anywhere. Anywhere it gets muddy is a good place to make plaster-of-Paris molds of animal tracks. If nothing else, step in some mud with your bare foot and make a mold of your footprint. Do not forget that you are a consumer too.

In winter, many footprints are left in the snow. It is possible to make plaster molds in the snow. It is harder than in mud, but you can do it if you try hard. The only thing different is in step 2. Do not spray the track with shellac. Spray it with water instead. When the water freezes inside the track, make your

mold. If you try it several times, you will be able to do it. You have to be careful that the snow does not move while you do it.

ED 068366

Decomposers and Decomposition-1



Shelf-fungus



Mushroom

Name: _____

DECOMPOSERS AND DECOMPOSITION-1

What you will study

Decomposers

Decomposition

What you should be able to do

1. Find examples of decomposition.
2. Find some actual decomposers.
3. Find animals that live in rotting logs.
4. Tell why decomposers are important in a woods and other places.
5. Tell what decomposers do to organisms when they decompose them.
6. Tell how animals in rotting logs help decomposers.

What you need to know

Tiny living things called bacteria make things decay and rot. They are too tiny to be seen with your eyes. Bigger living things called fungi also make things decay and rot. They can be seen quite easily certain times of the year. Decaying and rotting are known as decomposition. The bacteria and kinds of fungus that cause decomposition are known as decomposers.

Two kinds of fungus are easy to find. One type is mushrooms. You have probably seen mushrooms before. Another kind of fungus often seen in a woods is a shelf-fungus. This type of fungus forms shelves on the sides of trees and logs. There are many other kinds of fungus besides mushrooms and shelf-fungus.

The best time to find mushrooms and other types of fungus is in the late summer and early fall. However, some can be found year

round. Since decomposers, like all living things, need water, you generally find more of them in wetter places. Whether or not you find the decomposers, it is easy to find decomposing objects in a woods, no matter what time of the year it is.

What you need

activity packet and pencil

What you should do

1. A woods is the best place to see decomposers and decomposition. Any woods, big or small, is a good place if it has dead logs lying around. If you cannot visit a woods, there are other ways to study decomposers and their work. One way is to bring decomposing logs from a woods to be looked at somewhere else. Decomposition of wood occurs many places besides a woods. For other

ways to study decomposition besides going to a woods, see the last section of this activity.

2. Walk through the woods and look first for examples of decomposition. The best examples are rotting tree trunks and logs. Examine them with your eyes and hands. Push them. Feel them. Pull apart a little bit of the decaying pieces. Write down on the blank pages anything you can about decomposing logs. Look for other objects **besides** logs which are decomposing.

As you pull the rotting pieces apart, remember that it was once a living tree. It used to be a hard piece of wood. Decomposition by kinds of fungus and bacteria have changed it to what it is now.

3. After you have looked at examples of decomposition, see if you can find any actual decomposers. Look for mushrooms,

shelf-fungus, and any other decomposers. Remember that the time of year makes a difference in how many you will find.

Decomposers can be large or small, so look very carefully. Make a drawing of any you find. Write down what the decomposer is decomposing if you can.

4. Many times decomposers are helped in their work by animals. Look for any animals living in decaying material. Expect to find things like insects, insect larvae, worms, spiders, and other animals. Draw a picture or write a description of any you find.

Questions to answer

What does a decomposing log look like?

What decomposes in a woods besides trees?

Were some trees more decomposed than others?

If so, how did this happen?

What kinds of decomposers did you find?

Where did you find mushrooms?

Where did you find shelf-fungus?

Did you find any decomposers growing on living trees or other plants?

What kinds of animals did you find in rotting logs?

How might they help the decomposers?

Do you think such animals should be called decomposers too?

Why are decomposers necessary in a woods?

Questions to think about

Are decomposers found just in a woods?

Where else can they be found?

Why are decomposers necessary throughout the world?

How do they fit into a food chain?

What would happen if there suddenly were no decomposers in the world?

What part of a mushroom or shelf-fungus does the decomposing?

Is it the part you see, or is it the part you do not see?

Other ways to do this activity

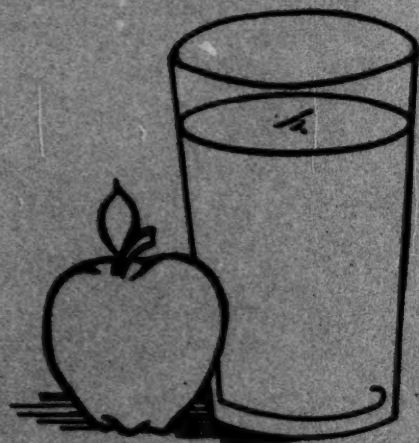
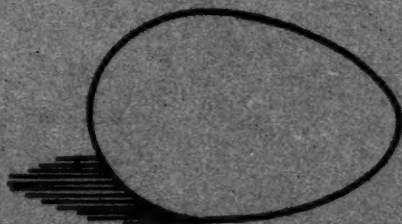
If you cannot go to a woods, bring the woods to you. Perhaps

someone in your class or your teacher can bring one or several rotting logs to class. Examine them as you would have outdoors. Maybe someone can bring in mushrooms or shelf-fungus to look at in class.

Even in a city, wood decomposes. Boards and crates in alleys and fields rot. Wood along lakes and streams is always rotting. Almost anywhere you live, you should be able to find examples of rotting wood. If you have to, use such examples in place of a hike to a woods.

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Decomposers and Decomposition-2



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DECOMPOSERS AND DECOMPOSITION-2

What you will study

Decomposers

Decomposition

What you should be able to do

1. Find out what kinds of objects and things decompose.
2. Find out how long it takes certain objects and things to decompose.
3. Tell how things change when they decompose.

What you need to know

Tiny living organisms called bacteria and others called fungi make things decay and rot. The process of decaying and rotting is known as decomposition. The living things that cause this are known as decomposers.

Many times you can tell something is decomposing by its smell. When meat spoils, it is being decomposed by bacteria in the meat. You usually smell it before you see it in this case.

It is important to know that decomposition is faster in warm and wet areas of the earth. The decomposers need heat and moisture to do their work.

What you need

- | | |
|-------------|-----------------------------|
| 1. an apple | 5. a peanut |
| 2. a nail | 6. a cup of milk |
| 3. an egg | 7. a tomato |
| 4. a peach | 8. a piece of aluminum foil |

What you should do

1. First, gather the eight things listed above. (You may add others if you wish.)

2. Since you will be watching them for two weeks, find a spot to put them where they will not be bothered. Remember, you need to find a warm and wet place to put them.

If it is spring, fall, or summer, you will probably be able to put them outdoors. But it must be a place where no person or animal will bother them. You will not want animals to eat them or carry them away.

If you put them indoors, remember that smells are often given off as things decompose.

3. Sprinkle some water on each object after you have found a place for them to decompose.
4. Allow the objects to stay where they are for at least two weeks. Check them each day. Look for any changes

in each of the objects that might tell you decomposition is going on.

5. Keep a record for each object on the blank pages at the end of this activity. Think of your own way to keep a daily record. Write down any changes you notice. If an object does not change, write that down, too.
6. As you check your objects each day, sprinkle a little water upon each object.

Questions to answer

Which of the objects showed change after two weeks?

Which objects showed no change?

Did any of the objects show a change that you think was not caused by decomposers?

What kinds of objects do decomposers work on? How are they alike?

Did any objects seem to decompose faster than others?

Which object first started to decompose?

Which object was the last to decompose?

Why do you think some objects decompose faster than others?

Other things to think about

What kind of decomposition goes on inside your mouth?

If there were no decomposition on earth, what might happen?

How does decomposition help the soil that plants grow in?

Follow-up

You can let your objects keep decomposing longer than two weeks. Let them keep going for as long as you wish. But keep a daily record so you will not miss anything.

You can also use other objects to see if they decompose. Some interesting objects might include:

marshmallow	bread
butter	candy
banana	

You may want to find out how temperature or water affect the way things decompose. Pick one of the things you used before that decomposed quickly. Put one inside where it is warm and another outside where it is cold. Check them both each day to see which is decomposing faster.

To see if water affects decomposition, get two of the same objects and keep them inside. Sprinkle one with water each day. Keep the other dry. See if one decomposes faster than the other.

Think up other ways to test how temperature and water affect decomposition.

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Food Chains and Nutrients



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Center No. C-03/Contract OE 5-10-54

FOOD CHAINS AND NUTRIENTS

What you will study

Food chains

Nutrients

What you should be able to do

1. Write or tell a story about what happens to a nutrient as it goes through several food chains.
2. Draw pictures of the different food chains a nutrient can go through.
3. Tell of other places nutrients might go besides food chains.

What you need to know

If you watch an insect eat a plant, a frog eat the insect, and a snake eat the frog, you are watching a food chain. This food chain keeps on going if a hawk eats the snake.

Suppose the hawk drops some waste on some soil near a plant. The plant may use something from the hawk's waste to build a new leaf. If a worm eats the leaf, if a bird eats the worm, and if a cat eats the bird, this is another food chain. If you think very hard, you will see that it is possible that part of the plant eaten by the insect in the beginning has finally become part of the cat. Nutrients, the building blocks in the plant, have followed a complicated route to become part of the cat. They can keep on going.

Food chains always start with plants, the producers. They end with animals, the consumers. There are usually several consumers and producers in food chains.

What you need

1. activity packet
2. pencil

3. chalk
4. tape recorder (optional)
5. Marsh-Chart (from the activity called Marsh (Community))

What you should do

Think of yourself as being very small. Be so small that you cannot be seen. Be so small that you are as small as a nutrient in a marsh.

Make up a story that starts in a marsh in which you are a nutrient. Tell what adventures you have had in the last ten years. Use the Marsh-Chart you filled in earlier to help you think of places a nutrient might go in a marsh and its food chains. Think of other places besides a marsh where you might go.

In your story, answer questions like:

1. What different food chains have you been through?

2. How did you get from one food chain to another?
3. When were you not part of a food chain?
4. How important were you as a nutrient?
5. Any others you think of.

Think of a name for your story. Write it out for others to read, or tell it before the class. If your school has a tape recorder, record your story for others to hear.

Draw pictures on the chalkboard and on the blank pages at the end of this activity of the different food chains you went through as a nutrient.

Listen to your classmates' stories. See if they are different from yours.

Questions to answer

What would you tell someone if he asked you what a food chain was?

Why are food chains important?

How are food chains important to man?

How are nutrients important in food chains?

Are food chains found in places besides marshes? Where?

Questions to think about

As a human being, what is your food chain like?

Are you at the beginning or end of the food chain?

Is it a simple or complicated food chain?

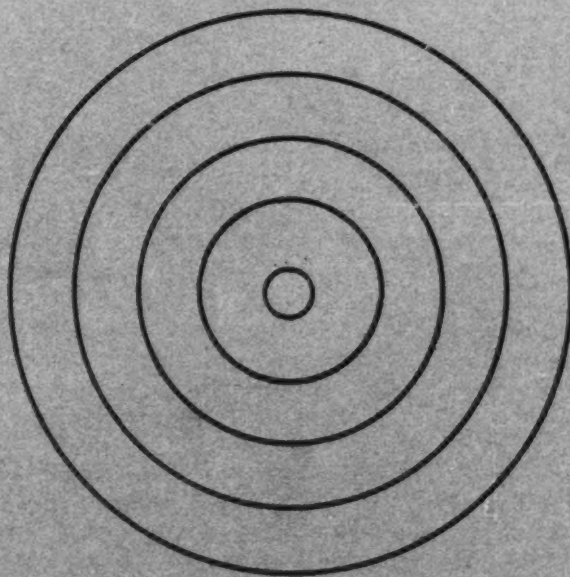
Do you need nutrients in your food chain?

Why should man be careful that he not destroy part of his food chain?

How is the food chain of people in India or China different from the food chain of most people in the United States?

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Habitat



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Center No. C-03/Contract OE 5-10-74

HABITAT

What you will study

Habitats

What you should be able to do

1. Write a description of the habitats of some familiar animals.
2. Arrange the animals you describe into an order from the one with the smallest to the one with the biggest habitat.
3. Tell how habitats depend on the size of an animal, the way it moves, its food chain, where it sleeps, and the way it lives.

What you need to know

The habitat of an animal is all the space it needs to feed, protect, and shelter itself. Some animals have very large

habitats. Others have very small ones. An eagle's habitat might cover several square miles. A mouse's habitat might cover just a few square yards.

What you need

activity packet and pencil

What you should do

1. Below is a list of different animals you might be familiar with. Some of them have rather large habitats. Others have small ones. Some are in-between.

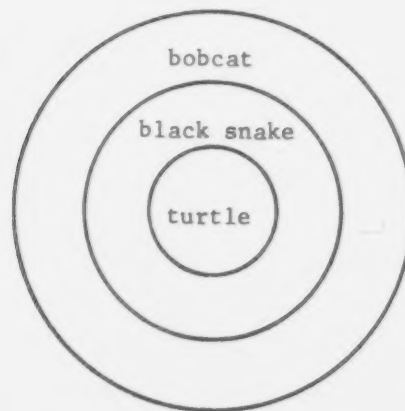
Put a check mark beside each animal in the list that you know something about. For each animal you checked, write down a short description of what type of habitat you think it has.

List of animals to choose from:

muskrat	mole	carp
robin	you (as an animal)	worm
snail	rat	flea
grasshopper	mouse	fly
deer	bat	starling
salmon	crow	raccoon

2. Arrange the animals you checked in order from the one with the smallest habitat to the one with the largest habitat. Use your written description to help you. Use bigger and bigger circles to represent the space of the animal's habitat. The animal you feel has the smallest habitat should be in the center circle. The one with the largest should be in the outermost circle.

Here is a simple example.



Put your habitat drawing with others made by your classmates. See how they compare with yours. See how they are alike and how they are different.

3. Ask yourself if the size of each animal's habitat has anything to do with the animal's
 - a. size
 - b. way of moving
 - c. food chain
 - d. sleeping place
 - e. way of living
4. Make the same kind of circle chart for any animals that you have an interest in that are not on the list.

Questions to answer

Which of the animals you chose has the largest habitat?

Why do you think so?

Which animal did you choose as having the smallest habitat?

Why?

What would you tell someone if they asked you what a habitat is?

Questions to think about

Do you consider man to be an animal?

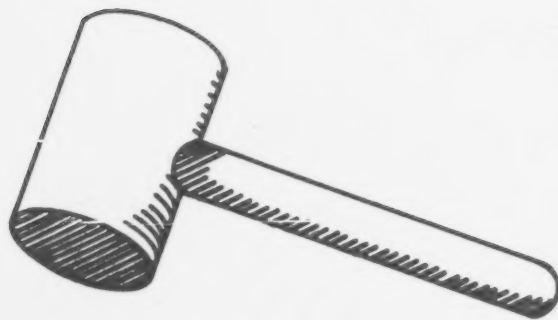
Why or why not?

Why does man put more pressure on his habitat than any other animal?

What happens when an animal's habitat is destroyed? How does one animal affect the habitat of another?

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Hearing-1



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Center No. C-03/Contract OE 5-10-54

HEARING-1/

What you will study

A hearing

What you should be able to do

1. Find out how hearings are conducted.
2. Act out a hearing.
3. Choose environmental problems in your community to study and to use for a class hearing.
4. Gather information about environmental problems to help you decide how you feel about the problems.
5. Hold a class hearing about a problem.
6. Tell how your hearing was valuable in dealing with the problem discussed.

What you need to know

A hearing is a meeting at which people can discuss their feelings about a problem. The people who have to make a decision about the problem listen to the different opinions. Hopefully, this helps them make a decision about the problem.

Many hearings are about problems which affect the environment.

Examples of hearings about environmental problems are:

1. making new laws about pollution
2. building a new road
3. preserving a wildlife area
4. doing away with billboards
5. noise pollution

Of course, there are many other environmental problems about which hearings are held.

What you need

no special needs

What you should do

1. To get ready for a class hearing, you should first act out a hearing. To do this, you should gather information about how hearings are conducted. Ask your parents or teachers how hearings are organized. Ask them questions like:
 - a. Who is in charge of a hearing?
 - b. Who decides who should talk and in what order?
 - c. Are people allowed to ask questions of the people talking?
 - d. What happens if people start arguing?

When your class feels it knows enough about how hearings

should be run, act out a hearing about the story below. Later on, your class will have a real hearing about some problem in your own community.

2. Here is a story about an environmental problem. As a class, discuss what different opinions might come up at a hearing. Prepare a short play about the hearing. Choose someone to be in charge of the hearing. Write a script, if you wish, for the actors and actresses to learn. Perform your play in class. If you wish, present it to another class. Ask them how they felt about the different opinions you included in your play. Here is the story.

The city council of Centerville has been trying to think of ways to make some money for the city. They need the money to repair and

maintain their city streets. The council members have decided that building a large amusement park could solve their problems. It would bring in tourists from all over the state. The money from the amusement park would be more than enough to improve the city streets.

The only place to put the amusement park is at the city park. There is no place big enough anywhere else in the city. The park has been a picnic and hiking spot for the Centerville citizens. The lake at the park is a good place for ducks to nest.

The city council knows that many people will dislike having the park changed into an amusement park. But the council also knows that people want their roads repaired. The council decides to have a hearing about the problem.

3. Now that your class knows something about a hearing, it is time to pick environmental problems in your community. Your class should pick the problems. Then small groups should get ready for the hearing on a problem.

As you get ready for the hearing, your small group should take these steps.

- a. First study the problem. Learn as much about it as you can. The more you know about a problem, the better you can discuss it and form opinions about it.
- b. List all the different solutions you can think of to the problem.
- c. Discuss what would happen if each of the different solutions were carried out. Who or what would be affected by these solutions?

- d. Go back and pick the one solution that seems best to your group. This will be the part you will want to present at the hearing.
 - e. Make any charts or drawings you will need.
 - f. Plan how your group will present its opinions at the hearing.
4. When all groups are ready, hold your class hearing about the environmental problem you chose. You can follow the same procedure as in the hearing you acted out. Someone should be chosen to conduct the hearing.

Remember that a hearing should be orderly. Everyone should have his turn to speak. All sides of the issue should be heard. That is why it is called a hearing.

After the hearing is over, find out if any groups or individuals changed their minds about a solution to the problem.

Questions to answer

How is a hearing conducted?

How many different solutions to the problem were presented in your class hearing?

Were there any solutions presented that your group did not think of?

Who would be affected by the different solutions?

What troubles did you have in your class hearing?

Do you think real hearings have the same problems?

How was your class hearing valuable in dealing with the problem you chose?

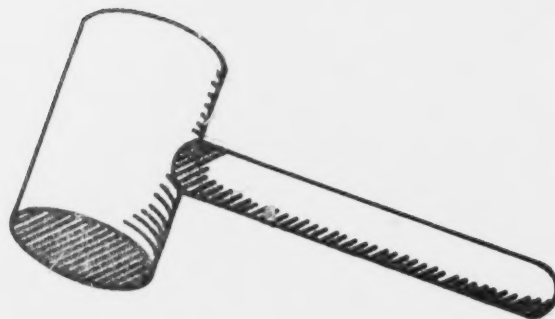
Questions to think about

How are hearings valuable in solving environmental problems?

How might a hearing prevent an environmental problem from being solved?

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Hearing-2



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Center No. C-03/Contract OE 5-10-54

HEARING-2

What you will study

A hearing

What you should be able to do

1. Tell why hearings about environmental problems are held.
2. Tell how a hearing is conducted.
3. Tell who is involved in a hearing.
4. Tell why a hearing is important in dealing with environmental problems.
5. Act like a reporter and write a newspaper article about the hearing.
6. Watch for any decisions made about the problem discussed at the hearing you attended.

What you need to know

A hearing is a meeting in which different opinions are discussed about some problem. These discussions help people make a decision about the problem. Public hearings can deal with almost any subject. Some are about very local problems; others are about national problems.

Many hearings deal with environmental problems. Examples of such hearings include:

1. the location of a highway
2. the draining of a marsh
3. what to do with garbage
4. whether to build a dam
5. how to cut down noise
6. where billboards should be placed

The dates and meeting places for hearings are almost always listed in the newspaper weeks before they are held. The problem to be discussed is also listed. Some newspapers have a special "Public Notices" section where hearings are listed. Other newspapers use different ways to announce them.

For this activity, you should try to go to a hearing about an environmental problem. If you cannot, other ways to do this activity are listed in the last section. You can go to other types of hearings or use tape recordings, television, and newspapers in place of attending an environmental hearing. But there is no better way to do this activity than by going to an environmental hearing in person.

What you need

activity packet and pencil

What you should do

1. Watch your local newspaper for an announcement about a hearing on an environmental problem. Go to the hearing. Act like a newspaper reporter. Watch what goes on and make notes about it. Here are some questions you should try to answer as you are at the hearing.
 - a. What was the environmental problem being discussed?
 - b. Who were the main people or organizations that talked?
 - c. Were there many opinions given? What were they?
 - d. Were all of the different opinions explained well?
 - e. Who used facts to explain their opinions? Who did not use facts?
 - f. Did everyone who spoke at the hearing act like you think grown-ups should?

- g. Were the speakers interested in how they would be affected by the outcome of the hearing? Did they show interest for more than just themselves?
2. As a reporter, write a newspaper article about the hearing. Try to answer the above questions the best you can. Include any other interesting information. Either report to your class about what went on, or have them read your article.
3. Keep watching the newspapers for any other stories about the outcome of the hearing you went to. Even if it takes several months, try to find out what final action was taken.

Questions to answer

Why do we have hearings?

How are hearings conducted?

Who can go to and speak at hearings?

Why are hearings important in dealing with environmental problems?

Do you think hearings are worthwhile? Why?

Questions to think about

Are hearings the only way to deal with environmental problems?

Other ways to do this activity

If you cannot go to a hearing about an environmental problem, go to one that is not about an environmental problem. Such hearings often deal with laws, taxes, and budgets for the government.

If you cannot go to any hearing, gather information about them from magazines or newspapers. Try to answer the questions using information you gather.

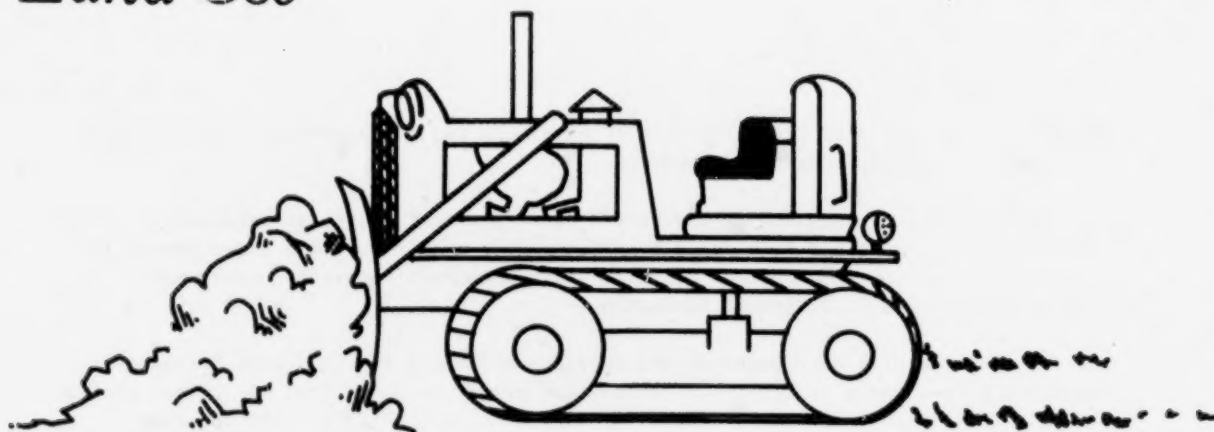
A tape recording of a hearing would be very nice to listen to if you cannot go to a hearing. Perhaps an adult or your teacher could get one for you to listen to. However, to tape record a hearing yourself would mean getting permission well ahead of time from the people in charge. They may even have rules against doing this.

Some hearings are on television. This does not happen very often. But if you are able to find one, watch it.

All of these ways will help you learn about hearings.

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Land Use



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LAND USE

What you will study

Land use

What you should be able to do

1. Make a display of where you live.
2. Tell why the different areas of your community are located where they are.
3. Decide where a new highway could be built in your community.
4. Decide whether a new highway should be built in your community.
5. Tell who would be affected by such a new highway.
6. Tell how they would be affected.

What you need to know

Land is used in many ways. Some land is used for farming while

some is used to put buildings on. Some is used for parks and some is used for highways. There are many other ways land is used. When land is being used one way and someone decides it is going to be used another way, problems can arise. Such problems have to be looked at carefully. Often a group of people have to decide how to solve these problems. They must examine different ways to use the land. They must study how each way will affect the land and people involved. They must study what problems might arise over a long time.

What you need

- | | |
|----------------------|-------------------------------|
| 1. scissors | 5. masking tape |
| 2. old magazines | 6. scotch tape |
| 3. old newspapers | 7. any available art supplies |
| 4. drawing materials | 8. a map of your community |

What you should do

1. Form a group of 5 or 6 people, and make a display of your community. This display can be a model, a blackboard drawing, a bulletin board display, or any other kind of display. Use drawings, cutouts from magazines or newspapers, and other pictures that will help you recognize the different areas where you live.

If you live in a city, you should include areas like:

- a. business districts
- b. housing areas
- c. parks and recreation areas
- d. natural areas like marshes and forests
- e. main highways

f. farms

g. any other main areas of your community

If you live in the country, you should include areas like:

a. farms

b. croplands

c. forests

d. rivers and streams

e. lakes

f. main highways

g. any other main areas of your community

Be as accurate as possible. Try to keep different areas to their proper sizes. For instance, in your display a housing district will probably be bigger than

a shopping center. A farm will be ~~bigger~~ bigger than a highway. A map of your community will help you be accurate.

2. After you have finished your display, study each main area. Ask yourself why certain areas are located where they are. Look for reasons such as they are near water, have good soil, are on flat land, and others.
3. When you have finished looking at the different areas on your display, try this: If a new four-lane highway were going to be built in your community, where would you put it? The highway can go anywhere you want it to go, but your group will have to give reasons for its final location. Using a width of masking tape as the new highway, add it to your display. Think very carefully about what problems will arise if this highway were

actually built where you put the masking tape. Think of the ease of putting the new highway through a natural area, as well as the ways in which it would change the natural area.

4. When your group has finally become satisfied with the location of the new highway, show your display to the rest of the class. Tell them why you put the new highway where you did. See if they agree with your decision.
5. Up to now you have been asked to put a new highway in your display. Maybe during your study, your group thought a highway should not be built at all. Go back and think about all the things you talked about. As a group, decide whether a new highway in your community would be a good idea or not. Tell why you think it is a good idea or a bad idea.

Questions to answer

Why do you think certain areas of your community are located where they are?

Were there any areas that did not seem to have good reasons for being where they are?

If a new highway were built where you put it, who would be affected by it?

How would they be affected?

Do you think they would like the new highway there, or not like it?

What other problems might come up about your new highway?

Was it easy for your group to decide where to put the new highway?

Did you decide that a new highway in your community would be a good or bad idea? Why?

Questions to think about

If a new highway really were going to be built in your city, what people would have to make the decisions that your group did?

Do you think they would have more or less trouble than you did in coming to a decision?

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Marsh



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MARSH

What you will study

A marsh

What you should be able to do

1. Use your senses (smell, taste, touch, hearing, and sight) to study a marsh.
2. Tell what a marsh is like.
3. Tell what your senses found that were not natural to the marsh.

What you need

a marsh to visit

(If you do not have a marsh to visit, see other areas to study at the end of this activity.)

What you should do

If you are lucky enough to have a marsh nearby, go there and have a sensory hike. In a sensory hike, you do not move around much once you are at the marsh. Instead, find a nice spot near the marsh where you can sit quietly or stand still. Face the marsh, be still, and stop talking or making noise. Using one by one your five senses of smell, taste, touch, hearing, and sight, examine the marsh.

First, with your eyes closed, take a deep breath and smell the air. Really think about the smell of that air. What is different about it? Does it smell like something you have smelled before, or is it totally different?

Is there any taste to the marsh air? Take some more deep breaths. Think about how the air feels or tastes in your mouth and on your tongue.

Next, think about how you feel (your eyes are still closed). Is there a breeze or is the air still? What do you feel that is different from your classroom? Use your whole body to feel the marsh as you stand or sit still.

Open your ears to the marsh sounds. What do you hear? Do you hear any animals, plant movements, or water? Listen with all your might to the marsh.

Finally, open your eyes. Can you see what you heard, felt, tasted, and smelled? Look around at all there is to see in a marsh.

If you are able to return to the same spot in the evening or at night, have another sensory hike. Flashlights can be used to get to and from your spot, but must be turned off during the sensory hike. One rule to remember--no flashlights during the hike itself. How is the night experience different from the

day? Were any of your senses used more at night than in the day?

Questions to answer

Did your sensory hike tell you anything about a marsh that you did not know? What?

Describe the marsh to someone after you have taken your sensory hike.

What did your senses find at the marsh that were not natural to the marsh? For example, did you hear any sounds that did not come from the marsh itself?

Questions to think about

Which of your five senses told you the most about a marsh?

Which sense told you the least about a marsh?

Other ways to do this activity

You may want to do this activity, but do not have a marsh to visit. You can have a sensory hike wherever you like. Below are some other places you might want to go to have a sensory hike.

Remember, anywhere you think would be a good place is all right.

a bog	a pine forest
a city	a playground
a city park	a pond
a desert	a prairie
a lake	a river
a leafy forest	a swamp
a mountain	a yard
an old field	

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Marsh
(Community)



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MARSH (COMMUNITY)

What you will study

A marsh and its parts

What you should be able to do

1. Write down the kinds of living things and non-living things you can see in a marsh.
2. Show how the different things you see are related to each other.
3. Tell what a marsh is like after you fill in the Marsh-Chart.
4. Tell what kinds of animals and plants belong to a marsh community.

What you need to know

A marsh is an area that has many different animals and plants living in it. Many things which are not alive are also found in a marsh. Such things include water, rocks, soil, and air. The living things in the marsh are the marsh community. The marsh community and the non-living things make up a marsh.

All the different parts work together. In this activity you will learn how they work together. But first you should look at each part by itself. After that, it is easier to see how the parts work together. All of these things working together make the marsh what it is.

What you need

activity packet with Marsh-Chart, pencil

What you should do

In scavenger hunts you usually collect many things. Collecting many things from a marsh might damage the marsh. But you can have a kind of scavenger hunt by writing down the things you see in the marsh.

If your whole class visits a marsh, you might try this. Divide your class into five or six teams for a scavenger hunt. In one hour, see how many blocks on the Marsh-Chart you can fill. The Marsh-Chart is the last four sheets of this activity.

If your class cannot visit a marsh, maybe you and a few friends can visit one on your own.

You can even go to a marsh by yourself and fill in the Marsh-Chart. Anything you see (or hear, smell, or feel) at a marsh can be used to fill in a block. Do not fill in a space

with something you honestly did not see, hear, smell, or touch.

To fill the spaces on the Marsh-Chart, put the name of what you see, if you know it, in the block. If you do not know the name, write down what it is like. Putting down what something is like counts as much as knowing the name. If you make more observations for one thing than the Marsh-Chart has room for, put your extras on the back of the chart. Also, when you find things not listed on the chart, put them in the blank spaces on the chart.

No one loses in this type of scavenger hunt. Everyone has helped to discover what makes up a marsh. Get together with anyone else who filled in a Marsh-Chart. See what they found that you or your group did not. Share your findings with them. Everything everyone observed plus many things which were not observed help make a marsh.

It is possible that you cannot visit a marsh. Maybe there are no marshes where you live. Maybe you just cannot get to one. If this is so, you can try to fill in your Marsh-Chart in other ways. You might ask someone who has visited a marsh to help you fill in the Marsh-Chart. Such a person can be another student, a teacher, or a parent. They may even have pictures of a marsh to show you. If you live near a museum, a visit there might help you. Many museums have displays of things like a marsh. Maybe you can think of other ways to find out about a marsh without visiting one.

At school or at home, see what you can learn from the observations on your Marsh-Chart. Work by yourself or in teams. Remove all four pages of the Marsh-Chart. Tape the four pages together to form a square sheet of paper. For each block you

filled in, try to draw an arrow from it to another block. The block that has the arrow pointing to it should in some way need what is written in the first block to keep living in a marsh. Suppose two of your blocks had "marsh water" and "frog" written in them. You would draw an arrow from the first block saying "marsh water" to the second block saying "frog." The frog needs the water to live in the marsh. If you use your imagination, you should be able to draw at least one arrow from every block to another block. Number each arrow. For each arrow you drew, tell why one block needs another. Arrows can connect two living things in the community. They can connect two non-living things. They can also connect a living and a non-living thing. In many cases, you may be able to draw several arrows from one block connecting it to many others.

Questions to answer

The first thing you did was list the parts of a marsh separately. Now that you have drawn your arrows, do you think all the parts of a marsh can get along by themselves? Do they need the other parts?

If you were to help someone fill in a Marsh-Chart without visiting a marsh, what would you tell them?

What is a marsh community?

Does a marsh community need the non-living parts of a marsh?

Do you think a marsh is a simple or a complicated place?

Questions to think about

How would the marsh be changed if you suddenly took away all of the animals that live there?

How would it change if all the plants were taken away?

How would it change if all the non-living parts were taken away?

How do man's activities change marshes?

Other ways to do this activity

You do not have to study a marsh to see a community. Many other kinds of communities are found in nature. You can study them just like a marsh. You would have to change the Marsh-Chart a little bit, but not much. Instead of a Marsh-Chart, you could make a River-Chart or a City-Chart. Below are listed some types

of communities that you might like to study besides or instead of
a marsh.

a bog	a pine forest
a city	a playground
a city park	a pond
a desert	a prairie
a lake	a river
a leafy forest	a swamp
a mountain	a yard
an old field	

MARSH-CHART

How to use it

Fill in as many spaces as possible. A description is as good as a name. When you find things not listed on this chart, use the blank spaces. Use the back of this chart if you do not have enough room.

	Observations		
	First	Second	Third
PLANTS			
Trees			
Bushes			
Plants with flowers			
Plants without flowers			
Plants in water			
Seeds			
Fruits			
Other plant parts			



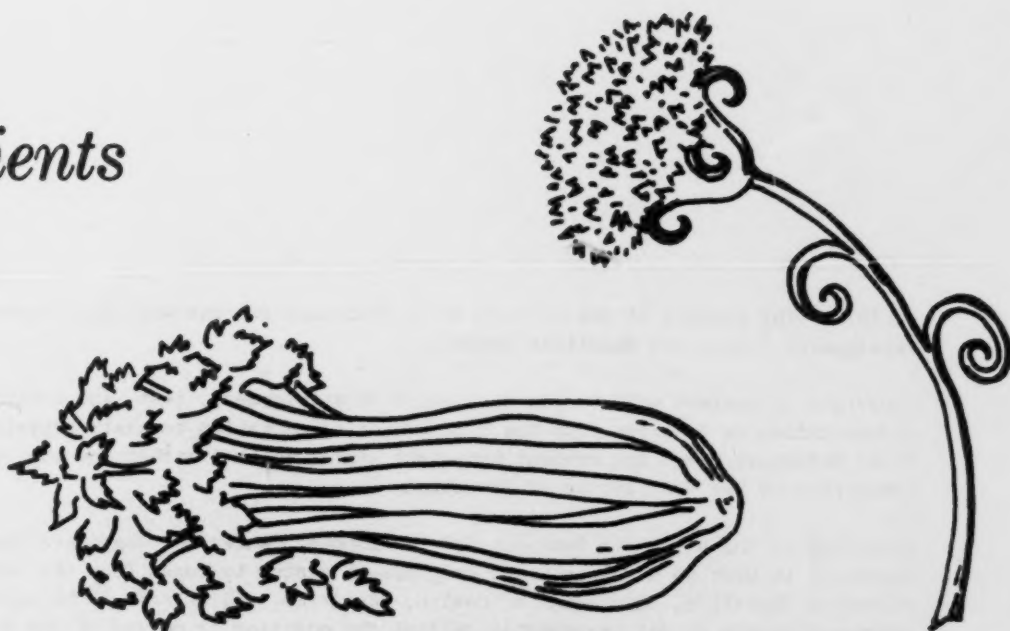
	Observations		
	First	Second	Third
ANIMALS			
Birds			
Mammals			
Reptiles			
Amphibians			
Spiders			
Insects			
Fish			
Other animals			

	Observations		
	First	Second	Third
ANIMAL SIGNS			
Animal tracks			
Animal sounds			
Animal homes			
Fur			
Feathers			
Other animal signs			

	Observations		
	First	Second	Third
NON-LIVING PARTS			
Marsh colors			
Marsh sounds			
Marsh smells			
Water			
Rocks			
Soil			
Clouds			
Weather			
Other non-living parts			

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Nutrients



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Center No. C-03/Contract OE 5-10-54

NUTRIENTS

What you will study

Nutrients

What you should be able to do

1. Show how nutrients move in plants.
2. Find parts in plants through which nutrients move.
3. Tell how root hairs help a plant get its nutrients.
4. Tell where the nutrients go in a plant when it dies.
5. Tell why nutrients are needed for plants and animals.

What you need to know

Plants make their own food. But they need certain materials to make this food. These materials are called nutrients. If a plant does not get the right nutrients, it will not grow properly or it may even die. (This same thing is true for animals.)

Plants get their nutrients from the soil. Water dissolves the nutrients in the soil. When this water is taken in through the plant's roots, the nutrients are also taken in.

When plants begin to grow, they need many nutrients. This is just like a new baby. A baby needs many nutrients at the beginning of his life. He gets these nutrients from his mother's milk or a mixed formula. However, a plant has to get along on its own. To help get its nutrients, a plant has special structures called root hairs.

What you need

1. a white carnation (optional)
2. celery
3. tweezers
4. red food coloring

5. a package of radish seeds
6. a glass or plastic dish with lid (Petri Dish)
7. paper towels
8. scissors
9. a microscope, hand lens, or magnifying glass

What you should do

First, you will see how nutrients move in plants. Second, you will see root hairs which help a plant to get its nutrients.

Part A

You may have seen white flowers called carnations having red-tipped petals. This is not the way they really grow. The people who sell these flowers cause the red tips to be that way.

If you can, go to a flower shop. Ask the person in charge to show you how they do it. Maybe you will want to buy a pure white carnation and try it at home.

If you cannot get a carnation, use celery.

1. Put some red food coloring in a glass of water. Pretend that the red coloring is the invisible nutrients in the water.
2. Put the carnation stem or the big end of a stalk of celery in the glass of red water.
3. Watch the carnation or celery to see where the red water goes. (It may take a day or two.)
4. Use tweezers to pull apart the carnation or celery to see where the red water went.

Questions to answer

How long did it take the red water to go up the carnation stem or stalk of celery?

Can nutrients get to all parts of a plant?

What did you see in the carnation or celery that tells you this?

Did you find special parts of the carnation or celery through which nutrients move?

Part B

1. Take a glass or plastic dish and cut a piece of paper towel to fit in it. Place the towel in the bottom of the dish.
2. Moisten the paper with water.
3. Place 15-20 radish seeds on the wet paper. (Other seeds work too, but radish seeds work best.)
4. Label the lid with your name and the date and cover the dish.
5. Watch each day. Make sure the paper towel stays wet.

6. After the seeds sprout, you should begin to see something fuzzy on the roots. These structures are called root hairs.
7. Take one of the roots with root hairs. Examine it closely with a microscope, hand lens, or magnifying lens to see the root hairs better.
8. Make a drawing of what you see.
9. Try to make an approximate count of the number of root hairs on one root.

Questions to answer

How many root hairs do you think there are on one root?

How could all those root hairs help a plant in getting nutrients?

If the root hairs were sliced off, would a plant have a harder time getting nutrients?

What happens to the nutrients in a plant after it dies?

Are the nutrients gone forever? Why or why not?

Questions to think about

Why do plants need nutrients?

Do animals need nutrients?

Where do animals get their nutrients?

How do animals move their nutrients to different parts of their bodies?

Do animals have root hairs or anything like them?

What do you think is meant by the term nutrient cycle?

Follow-up

If you like math, you might try to figure out how long it takes nutrients to go from the roots of a tree to the top. Find out how long it takes nutrients to move up a foot-long piece of celery. This fact can help you get an idea of how long a nutrient takes to move up a tree. Some of our tallest trees are over 300 feet tall, not including the length of the roots underground.

Study root hairs of different seeds besides radish seeds. Get some different seeds and see how their root hairs are different.

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Producers



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Center No. C-03/Contract OE 5-10-54

PRODUCERS

What you will study

Producers (and how they grow)

What you should be able to do

Tell how these things affect the growth of producers.

1. light
2. heat
3. water
4. nutrients
5. air

What you need to know

Green plants make their own food. They produce the food eaten by animals. To produce food and to grow properly, green plants need certain things. If one or more of these things is missing, the plant is usually affected in some way that you can see.

What you need

1. many bean seeds; most hardware stores and farm supplies sell garden beans
2. soil to plant the seeds in
3. milk cartons
4. paper towels
5. a refrigerator
6. distilled water (drugstores and supermarkets usually sell it)
7. white sand (pet stores usually sell it for aquariums)
8. a plant food like "Vigoro"
9. Saran Wrap
10. plastic dry cleaning bags
11. rubber bands
12. masking tape

What you should do

Here are five experiments to do. In each experiment, you will compare two groups of plants. You will take something away from one of the two groups of plants. You will try to find out just what a plant needs to grow.

For each experiment, you should keep daily records on the blank pages provided. You should write down anything you see happening. Draw sketches of the plants as you watch them.

You may do as many parts of the activity as you wish. If you want to do all five of them, go ahead. If you only want to do one of them, that is all right too.

You may do them by yourself or you may do them in groups. Make sure that all five experiments get done by someone.

For all the experiments, you will need some bean seeds. Sometimes you will need milk cartons for bean pots. Just cut

the tops off for a ready-made bean pot.

A. Light

In this experiment you will compare two groups of beans. One group will have sunlight. The other group will not have sunlight.

1. Fill two milk cartons with two to three inches of loose soil.
2. Plant five bean seeds in each. Each seed should be about half an inch below the soil.
3. Place one carton by a sunlit window. Place the other in a dark place where no sunlight (or other light) will reach it.
4. Label each carton using a piece of masking tape. Put your name and the date on each carton. Mark the one in the window Light. Mark the other Dark.

5. Water each carton daily. The soil should never become dry, but it should never have water standing on it either.
6. Watch for at least two weeks. Each day record any differences between the two groups of plants. You may want to keep watching for more than two weeks.

Questions to answer about light

How does a green plant that gets sunlight differ from one that does not get sunlight?

Do plants need light to grow properly?

Were you surprised at what happened?

Do you think farmers have to worry about light for their crops? Why?

B. Heat

In this experiment, you will again compare two groups of beans. One group will be grown at room temperature. The other group will be grown in a refrigerator.

1. Soak 20 beans in water overnight.
2. Divide your beans into two groups of 10.
3. Moisten four paper towels, two for each group of beans.
4. For both groups put 10 soaked beans between two moist towels.
5. Roll each set of towels with 10 seeds between them into a cylinder. Fasten each with a loose rubber band.
6. Label each roll of towels with your name and the date. On one set write Warm. On the other write Cold.
7. Put the Cold group of beans in a refrigerator (where milk might be kept). Put the other in a dark place in the room.

8. Each day make sure the towels are moist. Sprinkle water on them as needed.
9. After a week, open the towels and compare the two groups of seeds.

Questions to answer about heat

How does temperature affect the sprouting of seeds?
Does a plant need heat to start growth properly?

What do you think would happen if you put a plant already sprouted in the refrigerator for a week?

C. Water

In this experiment you will compare three groups of beans. One group will be watered normally. The other two groups will not be watered normally.

1. Fill three milk cartons with two to three inches of loose soil. Plant five bean seeds in each carton about half an inch below the top of the soil.
2. Place all three cartons in a sunlit window.
3. Label each carton with a piece of masking tape. On all three cartons, put your name and the date.
4. Label one carton Normal. Label another carton One Week Only. Label the last carton None.
5. For at least two weeks, water the carton that says Normal every day. The soil should never become dry, but it should never have water standing on it either.
6. Water the carton that says One Week Only just like the Normal carton for the first week. Do not water it after the first week.
7. Do not water at all the carton that says None.

8. Watch all three groups carefully for at least two weeks. You may have to watch for three or four weeks if the beans are slow to sprout. Keep a written record each day of any differences between the three groups of beans.

Questions to answer about water

What happens to the growth of a plant when it has no water? Is water necessary for proper plant growth?

What happens to the growth of a plant when you stop watering it after it has begun growing?

D. Nutrients

In this experiment you will compare two types of beans. One group will grow without added nutrients. The other

group will grow with added nutrients. Distilled water will be used instead of faucet water. Distilled water has very few nutrients in it. Faucet water has many nutrients in it. White sand will be used in place of soil for the same reason. Testing for nutrient differences is hard, but possible if you are careful.

1. Clean and rinse two milk cartons with distilled water.
2. Fill both of them with two to three inches of clean white sand.
3. Plant five bean seeds into each carton of white sand about half an inch below the top of the sand.
4. Label each carton with your name and the date. On one carton write Nutrients Added. On the other write None Added.

5. To the carton labeled Nutrients Added, add a commercial plant food like Vigoro. Follow the instructions given on the package. Do not add anything to the other.
6. Water both cartons daily with distilled water for at least four weeks.
7. Each day write down how the two groups of beans are different. Look for differences in size, color, and appearance.
8. At the end of four weeks, pull the plants carefully out of the sand. Rinse the sand off the roots. Compare the roots of the two groups.

Questions to answer about nutrients

How do nutrients affect the growth of plants? Are nutrients needed for proper plant growth?

How were the stems and leaves affected?

How were the roots affected?

E. Air

In this experiment you will compare two groups of bean seeds. One group will be exposed to air. The other group will not be exposed to air.

You will need two kinds of plastic sheets to do this experiment. Each sheet should be about the size of notebook paper. One kind of plastic is Saran Wrap. The other is the kind of plastic bag that comes from the dry cleaner. The Saran Wrap will not allow air (oxygen) to pass through it, but the plastic bag will.

1. Soak 20 bean seeds in water overnight.
2. Place a half cup of wet dirt in the center of a

- piece of Saran Wrap and another half cup of wet dirt in the center of a piece of a plastic bag.
3. Place 10 soaked seeds into each pile of dirt.
 4. Draw the four corners of each piece of plastic together and twist to make a little bag. You should gently squeeze out any air left with the seeds and wet dirt.
 5. Fold over the twisted part of each bag. Seal each tightly with a rubber band to stop air from getting in or out of the twisted part.
 6. Label each bag with your name and the date. Mark the Saran Wrap with No Air. Mark the other with Air.
 7. After four or five days, open the bags and look at the beans.
 8. Write down the number of beans that sprouted in each bag. Write down any other differences you noticed.

Questions to answer about air

Is air necessary for plant growth to begin?

Do you think air is needed by plants after they have sprouted?

As each person or group completes its experiments, check with each other to see what is happening. After you are **through**, present a report to the class. Tell them about your experiment and what you learned about the basic needs of a producer. Show them the plants or seeds so they can see any differences.

If you get results that you did not expect, or no results at all, do not worry about it. Do your best to explain what happened.

If other groups in your class performed the same experiments, be sure to compare results.

Questions to think about

What would happen to the world's food supply if the sun's light were suddenly cut in half?

How might temperature affect the way plants grow at the North Pole area compared to the equator?

What happens to land producers when there is a drought?

Why do some farmers add fertilizers to their crops?

Why do some farmers not have to add them?

What might happen to producers if air pollution keeps getting worse?

What would happen if all producers suddenly died?

What would happen to the food supply if too much land were used for building houses and roads?

ED 068366

Producers and Consumers



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Center No. C-03/Contract OE 5-10-54

PRODUCERS AND CONSUMERS

What you will study

Producers

Consumers

What you should be able to do

1. Tell if a living thing is a producer or a consumer.
2. Tell if man is a producer or a consumer.
3. Tell which foods you eat come from producers.
4. Tell which foods you eat come from consumers.
5. Tell if producers or consumers are more important to man.
6. Show how foods for consumers come from producers.

What you need to know

All living things need food to live. Some living things make their own food. Others cannot make their own food. They get their food from other living things.

What you need

activity packet and pencil

What you should do

1. Divide the piece of blank paper at the end of this activity into two parts.
2. Make a line down the center.
3. Mark one side of your paper "Foods which come from living things that make their own food."
4. Mark the other side of your paper "Foods which come from living things that do not make their own food."

Now, do Part A, B, or C. (You may want to do more than one part.)

Part A

Take your packet and pencil with you to the supermarket when

your parents go to buy groceries. For each food they buy, decide which side of the paper to write it on. For example, you would write "potatoes" on the side of your paper where groceries come from living things which make their own food. Potatoes are plants which make their own food. On the other side you might write "eggs." Eggs come from chickens. Chickens do not make their own food. A chicken has to eat grain for its food.

Part B

You can do this same activity at home. List the groceries in the cupboards. List the foods in the refrigerator. Decide on which side of the page each one belongs.

Part C

You can also do this same activity at school. Make a list of as many foods as you can think of. Some of your classmates may be

able to help you. Teachers, secretaries, and other adults can also help. Decide on which side of the page each one belongs.

When you have finished at least one of these activities, do Parts D and E.

Part D

After you have finished making your lists, try this next step. After each food on the two lists, write down what type of living thing it came from. For instance, a potato comes from a potato plant. This is pretty easy, but a food like bread is harder. After bread, you might write "wheat" since flour for most bread is made from wheat. However, you might write "rye" instead of "wheat" depending on the kind of bread you buy. Also, bread has other materials besides flour. But since flour is the main thing

in bread, "wheat" is all you would need to write. After eggs, you would write "chicken."

Questions to answer

Which side of your paper has more foods listed?

Which group of living things makes its own food?

Which group does not make its own food?

Which group would you name Producers?

Which group would you name Consumers?

Are producers plants, animals, or both? How would you define a producer?

Are consumers plants, animals, or both? How would you define a consumer?

Part E

Take foods from your consumer list. See if you can show how

these foods come from producers. For example, the milk you drink comes from a cow which eats mainly grass. The cow is a consumer. It gets its food from grass which is a producer. Do this for as many of the consumers as you can. If you get stuck, look through books about food. Asking people like other students, teachers, parents, or the home economics agents of your county or area will also help.

Questions to answer

Are producers important to man?

Are consumers important to man?

Which do you think is more important to man, producers or consumers? Why?

Questions to think about

How many of the foods you studied grow wild? Which ones?

How many are grown by farmers? Which ones?

If you were a consumer a hundred years ago, where would you have gotten your food?

If you were an Indian living a thousand years ago, where would you have gotten your food?

What would happen if farmers grew food only for themselves, and there were no supermarkets?

What is the "Produce" section of a supermarket?

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Profit
(Land Values)



OR

?

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Center No. C-03/Contract OE 5-10-54

PROFIT (LAND VALUES)

What you will study

Profit

Land values

What you should be able to do

1. Find out how much money different areas of land are worth.
2. Find out why these areas have different values.
3. Find out what kinds of land have the highest profits when sold.
4. Tell how people decide what land is worth.
5. Show that a profit can be something besides gaining money.

What you need to know

Each piece of land in a city or county has a certain money value. Different kinds of land have different values. In most

cases, the city or county government decides land values. A special person who works for the government does this. He is known as a real estate assessor. He and the people who work with him decide what land is worth. Usually, they decide that land is worth so many dollars per acre. An acre is about as big as a football field.

If a person sells land for more than he bought it, the extra money he makes is called a profit. A city can also make a profit by selling city land. But if the city keeps its land and makes it into a park, for example, the people of the city profit by having a place to picnic and relax. In this case, the profit is not money.

What you need

a map of your city or county

(Draw one if you cannot find a printed one.)

What you should do

1. Using a city or county map, study land values of several areas such as the following:
 - a. the neighborhood where you live
 - b. a shopping center
 - c. the downtown
 - d. a natural area like a park or a marsh
 - e. a farm
 - f. any other areas that interest you
2. Mark the areas you will study with a marking pen.
3. Arrange to talk with your local real estate assessor.
Explain to him that you want to study land values. You may try to visit him at his office. Better yet, you might invite him to come to your school to talk with you.

Show him the areas you marked on your map. Ask him to give you an idea of how much money per acre each of the areas you marked is worth. You should write down what he says so you will not forget it. Also, ask him how much the land was worth before anything was built on it.

Other questions you can ask him are:

1. What were the land values when land was first settled?
2. Was all land at one time about the same in worth?
3. What makes one area worth more than another?
4. Is the value of land always given in terms of money?
5. What happens to land values when areas have buildings built on them?
6. Exactly how is the value of land determined?

7. Do the people who own the land always agree with what the assessor decides the land is worth?

8. Ask any other questions you can think of.

Other people who may be able to answer some of your questions about land values are city planners and real estate dealers. A city planner has to know land values in his work. Since a real estate dealer buys and sells land, he too has to know land values.

Questions to answer

Which land areas in your community are worth the most dollars?
Why?

Which of these land areas would bring the highest money profit
if the owner sold it?

Which area would bring the lowest money profit if sold?

For each area, try to think of a way that a person or a city community would get a profit other than money if the land were kept instead of sold.

Questions to think about

Can you think of other ways to value land besides dollars per acre?

What might happen to land values if the buildings on the land started to fall apart?

What might happen to a farmer's land value if apartment buildings were built around his farm?

Should land be thought of in ways other than its money value,
or the money profit it will bring when sold?

ED 068366

Wetlands



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WETLANDS

What you will study

Wetlands

What you should be able to do

1. Find out where wetlands are located in your area or state.
2. Find out where wetlands have been filled in since your state was settled.
3. Tell why you think wetlands are disappearing.
4. Tell why you think wetlands are important.
5. Tell if you think wetlands should be preserved.

What you need to know

A wetland is any area that has water at or above the ground. It always has plants growing in it. Almost all states have some type of wetland. Different kinds of wetlands are marshes, swamps, and bogs.

What you need

1. plastic sheets
2. marking pens (two colors)
3. an overhead projector (optional)
4. maps of your state showing wetlands of the past and present
(To get such maps, either write or visit such state offices as the Department of Natural Resources, or the state office of a federal body like the U. S. Geological Survey. If these places do not have such maps, they should be able to tell you where to find them. You can make your own maps if you like. Many highway maps mark wetlands. Use such maps to make a map that shows just the wetlands.)

What you should do

1. First study the map which shows where wetlands are found

today in your state. Try to see if any pattern exists as to the location of the wetlands. See if more are located near cities and villages, or more in the country. See if they are found in one part of the state more than another.

2. Next, look at the map which shows the location of wetlands years ago in your state. See if there are more or fewer of them today. Look to see if they were located in different places than today.
3. Compare the two maps. A good way to do this is to draw outlines of your state on two different plastic sheets. Make sure the outline on each sheet is the same size. On one map, draw today's wetlands with one color of marking pen. On the other, draw yesterday's wetlands in a different color. If you have an overhead projector to use, do so. Put one map over another to see how things

have changed. If your school does not have an overhead projector, hold the two sheets up to a window.

4. Think of reasons why wetlands are important to you, your community, and to all living things. Write them down on the blank pages at the end of this activity.

Questions to answer

Does your state have more or fewer wetlands today than it once did?

Why do you think this is so?

Why are wetlands important to you?

Why are they important to your community

Why are they important to all living things?

Do you think we should preserve our wetlands? Why?

Questions to think about

Why are housing developments, highways, and shopping centers often built on drained and filled wetlands?

How would our country or the world change if all wetlands were lost?

ED 068366

The World Around You: Cattails or Concrete?

Your Activity Packet

Name: _____



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INTRODUCTION

What is it all about?

This is your activity packet. It will give you a chance to do things to help you learn. To use it right, you must be active. As you do the different activities, carry your packet with you. It is your packet.

Who does what?

If you think you can do an activity by yourself, go ahead. If several of you feel like doing an activity together, do it. You can be on your own as much as you like. Sometimes your teacher will help you decide which activity to do. Other times, you will decide. If you need help, get it. Ask for help from your teachers, teacher's aides, librarians, custodians, principals, parents, classmates, or anyone else.

Where do you do the activities?

Many activities are to be done outside. Others are to be done inside. If possible, your teacher can take you certain places. However, this may not be possible in many cases. If you can get to certain places on your own, do so. Go to them after school or on weekends. It is very important that you try to do outside activities outdoors. But if you cannot, most of the outdoor activities include ways to do them inside.

What do you do first?

At the end of this Introduction, you will find an Activity Description Sheet. It describes each of the 19 activities in your packet. Read the descriptions. See which activities interest you.

Next look at the Activities Check List. It follows the Description Sheet. The first column recommends certain activities for you to do. You should do as many of these as you can. If you have time to do the others, do so. They are also very important activities. Together with your teacher, choose the activities you will do. They can be any of the 19 activities. Mark the ones you select in the second column of the Activity Check List.

The number of activities you finish will depend on two things. First, it will depend on which activities you choose to do. Some take longer than

others. Second, it will depend on how much time you have to do them. As you finish an activity, mark it in the third column of the Check List.

There is no order in which to do the activities. The activity called COMMUNITY-3 is the only activity that suggests you do it after some of the others. On the Activity Check List some activities are marked with a star (*). These activities take a long time to finish. If you do any of them, you should set them up quickly in order to finish them.

Why watch every day?

Often you will need to watch something for several weeks. Usually, during that time you will be looking for something to change. It is important to watch it every day. Things will change a little from day to day. If you look at something one day, and then look at it again two weeks later, you know it has changed a lot. But you have missed all the exciting small changes leading up to the big change.

A clock is a simple example. From hour to hour, the hands change position. A big change in the position of the clock's hands is caused by many small changes. Unless you watch the clock every few minutes, you miss all these small changes. (The moving of a clock's hands, of course, is not the kind of change you will be watching in your activities.)

Why write it down?

If you watch something day by day, you should always write down what you see. If you do not, you will forget the small changes which make the big change. When you write things down, you can look back and study them. When you try to remember things, you easily forget them or get them mixed up. Each activity has blank paper at the end on which to write things down, make charts, and draw pictures.

Can you change things?

While you are doing an activity, you may think of something to do that is not in the instructions. Go ahead and do what you are thinking of if you can. Remember, it your activity packet. What you think is important. What you do is important.

Have fun!

You should have fun doing these activities. They are supposed to be fun. As you have fun doing them, you will discover things which are new to you. The harder you work, the more fun you will have. The fun of discovery depends a lot on you.

Activity Description Sheet

Adaptation and Habitat

In this activity you use your imagination. Using words and drawings, you put together an animal that could live in a make-believe place.

Community-1

In this activity you make an ant farm to study.

Community-2

In this activity you make a "little world" called a microcosm. You watch water plants and water animals to see what happens in a water community.

Community-3

In this activity you make a land community. Land animals and land plants are watched in a glass case called a terrarium.

Consumers

In this activity you gather clues to discover which consumers live in an area. The clues are animal footprints.

Decomposers and Decomposition-1

In this activity you go outdoors and find examples of decomposers and decomposition.

Decomposers and Decomposition-2

In this activity you do experiments about things which decompose.

Food Chains and Nutrients

In this activity you write or tell a story about being a nutrient in a food chain.

Habitat

In this activity you study the habitats of animals you are familiar with.

Hearing-1

In this activity you go to a real hearing. You act as a newspaper reporter.

Hearing-2

In this activity you act out a hearing. Then you hold a hearing on an environmental problem.

Land Use

In this activity you make a model of the area in which you live. You study your model to decide where a new highway could be placed.

Marsh

In this activity you go on a sensory hike outdoors.

Marsh (Community)

In this activity you go on a scavenger hunt outdoors.

Nutrients

In this activity you work with flowers or celery and seeds to see how a plant gets nutrients and how nutrients move in a plant.

Producers

In this activity you do five experiments to see what plants need to grow properly.

Producers and Consumers

In this activity you look at the foods you eat to decide whether they come from producers or consumers.

Profit (Land Values)

In this activity you talk to a land assessor. You study why land is valued as it is.

Wetlands

In this activity you look at maps of the wetlands of your state to see how the wetlands have changed since the land was settled by people.

Activity Check List

Name of Activity	Activities Recommended	Activities Selected	Activities Finished
Adaptation and Habitat			
*Community-1 (Choose one)	X	-----	-----
*Community-2			
*Community-3			
Consumers			
Decomposers and Decomposition-1 (Choose one)	X		
*Decomposers and Decomposition-2			
Food Chains and Nutrients	X		
Habitat			
Hearing-1 (Choose one)	X	-----	-----
Hearing-2			
Land Use	X		
Marsh			
Marsh (Community)			
Nutrients			
*Producers	X		
Producers and Consumers	X		
Profit (Land Values)	X		
Wetlands	X		

(*means this activity takes a long time to finish; it needs to be set up quickly in order to be finished)